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THE QUARTERLY REVIEW *of* BIOLOGY

RECENT ADVANCES IN OYSTER BIOLOGY

(CONCLUDED)

BY P. KORRINGA

Government Institute for Fishery Investigations, Bergen-op-Zoom, Holland

XXI. HEREDITY AND SELECTION

HOWEVER satisfactory may be the advances in our knowledge of many aspects of the oyster's biology, we must admit a serious and regrettable lag in the development of our knowledge of its heredity. We all feel that differences in growth rate, in resistance to diseases and environmental conditions, in vigor, and in flavor, depend at least partly on hereditary qualities. So far we can only guess what part is due to differences in environmental conditions, micro-ecological differences included, and what is due to hereditary factors. We know that oysters born in France and in the Norwegian oyster polls are very susceptible to winter conditions (Spärck, 1951; Cole, 1951), but we are not sure that this is caused by hereditary differences and not by the high temperatures prevailing during the early youth of these oysters (Korringa, 1950). Neither do we know whether the lack of spat after relaying fair numbers of foreign oysters on German (Hagmeier, 1941) and Danish beds (Spärck, 1951) should be ascribed to hereditary patterns inappropriate to local environmental conditions, or to factors like dispersion or starvation of larvae, lack of collectors, or poor survival of the young spat (Korringa, 1950). No scientific evidence can yet be adduced for the assumption of Gross and Smyth (1946) that certain oyster populations are now genetically too uniform to preserve their ecological plasticity. Nelson (1947) and Stauber (1947, 1950) have reason to assume that there are at least three different physiological varieties of *Gryphaea virginica*, starting their breeding activities at 15°, 20°, and 25°C, respectively, but this has not yet been borne out by laboratory experiments, and it is still unknown whether or not such differences are wholly hereditary. Oyster culture would however profit greatly from exact knowledge about the existence of physiological races of oysters breeding at different temperatures. Hopkins (1946) noted that the growth and survival of spat of *Gryphaea gigas* grown in Northern Japan (Matsushima region) differ considerably from those of spat reared in the Hiroshima district in Southern Japan, which differences may or may not be hereditary. Loosanoff and Nomejko (1949) have rightly noted that observations and records of unusually fast- or slow-growing oysters are of significant biological value and interest, because they may indicate that within what appears to be a homogeneous population, there may be distinct fast- or slow-growing races. Experimental evidence is not yet available. Nelson too (1946b) has stressed that we know virtually nothing about inheritance in oysters, and that no one has bred exclusively from fast-growing oysters in an effort to find out whether or not they will pass on this

capacity for rapid growth to their offspring. He also noted that the enforcement of size limits for oysters fished on natural beds may be particularly dangerous, since slow-growing oysters are returned to the beds again and again.

However, the advances made recently in the technique of tank breeding and of rearing oyster larvae in the laboratory give us the tools to carry through a study of oyster heredity, the results of which might greatly benefit the oyster industry (Cole, 1951; Imai et al., 1950; Kesteven, 1941; Korringa, 1950). With these methods clear-cut results might be obtained more cheaply and in a shorter time than from the creation of extensive spawning sanctuaries stocked with the largest, healthiest, and most vigorous oysters possible, as advocated by Kesteven (1941) and Nelson (1946b).

To improve quality and quantity in the production of oysters Nelson (1946b) has suggested both a thorough and unbiased study of the qualities of the more promising foreign oysters and the carrying out of hybridization experiments. The latter is on the assumption that hybrids demonstrate an increased vigor, so that it might be possible to grow oysters to full market size in two years, instead of the five to six required now. Imai, Hatanaka, Sato, Sakai, and Yuki (1950) have already started cross-breeding experiments with the purpose of improving the quality of the Japanese oyster. They failed, however, to produce hybrids of *Gryphaea virginica* and *Gryphaea gigas*, a result which agrees with those of Davis' experiments (1950b). Fertilization and early larval development proceeded apparently normally in this interspecific hybridization, but between the sixth and the tenth day all the larvae died, while the non-hybrids could be reared till setting.

I wonder whether there is enough evidence for Nelson's view that hybrids are of such outstanding vigor, and if so, whether this will hold good for intraspecific hybrids too, as the possibility of breeding interspecific hybrids is still doubtful. Intraspecific hybrids like those produced by Imai et al. may combine several desirable qualities, but I do not see how this could lead to a better breeding stock, since it cannot be expected that their offspring will demonstrate the same constant combination of qualities, unless one could succeed in breeding polyploid oysters. Or is it Imai's idea to go on with the production of hybrid oysters in tanks, generation after generation?

Though I am not yet convinced of the practical value of hybridization experiments in oysters, I do agree with Cole, Kesteven, and Nelson that genetical research should be initiated as soon as possible with the aim of selecting and fixing quick-growing, resistant strains of oysters of superior marketable qualities.

XXII. GEOGRAPHICAL DISTRIBUTION

Marked changes in the geographical distribution of oysters have occurred even in historic times. We should add, however, that in most cases man had a hand in it. We have discussed in a previous section why many natural beds of *Ostrea edulis* disappeared after a period of serious overfishing. Lambert (1946a) has listed the few scanty remains of the natural beds in France, which no longer play a part in the French oyster industry: "La situation a complètement changé, jadis les gisements alimentaient les parcs, actuellement certains ne subsistent peut-être que grâce à eux. Les grands gisements ont disparu. Faut-il s'en plaindre? De l'affaiblissement ou de la disparition des immenses bancs qui formaient jadis, tout le long des côtes, un cordon presque ininterrompu est née l'ostréiculture, une des plus belles industries de notre pays." That Lambert's view is correct follows from the fact that natural beds usually disappeared completely where no form of oyster culture was established after wasteful overfishing. This has for instance been the fate of the Scottish oyster beds (Millar, 1951), of the beds of the German Wattensee (Hagmeir, 1941), of the Heligoland oyster bank (Caspers, 1950), and also of several once flourishing Norwegian oyster beds. There are indications that oysters were once numerous in many places along the Norwegian coast, up to the Polar Circle, a range ascribed to slightly higher summer temperatures in an earlier geological period (Dannevig, 1951; Gaarder, 1950). Partly through such climatic changes, but mostly through man's wasteful activities, *Ostrea edulis* was forced to leave many of its northern outposts.

There is also evidence that *Gryphaea virginica* once lived further north on the Atlantic coast of the United States, a range which was presumably due to higher water temperatures in earlier times (Nelson, 1942). *Gryphaea angulata*, on the other hand, made a spectacular thrust in a northern direction. Lambert (1946a, 1950a) has described how the Portuguese oyster was relaid in the Basin of Arcachon in a period when flat oysters were

extremely scarce there. It was in the year 1868 that a shipload of Portuguese oysters, destined for Arcachon, was dumped in the Gironde estuary, and gave rise to the development of a vast and flourishing natural bed. A second bed came into being in the nearby Charente estuary, and smaller establishments were found further and further north in due course. The Loire estuary has been a natural barrier for a long time. Though no relaying of Portuguese oysters has been allowed north of the Vilaine River (Morbihan) since 1923, in order to protect the important culture of flat oysters in Brittany, spat of Portuguese oysters has in recent years repeatedly been found on collectors in the Morbihan district (Dalido, 1948). Lambert foresees that the Portuguese oyster will soon gain ground in a northern direction. "Les portugaises gagnent lentement terrain vers le nord. Il est surtout à prévoir que les portugaises allaient supplanter les plates dans les parcs." Lambert does not, however, foresee an economic disaster Brittany, since the Portuguese oysters are very resistant and easy to grow, and also because they sell more readily than flat oysters on account of their low price. We do, however, hope that the flat oyster, with its superior flavor, will not be ousted from Brittany, and the experience gained in the Basin of Arcachon, where both species are grown on a large scale, is reassuring. Vilela (1951) studied the oysters living on the Portuguese coast, and rejected Osório's opinion that *Ostrea canadensis* Lamarck and *Ostrea virginica* (Gmelin) occur there. The specimens under consideration no doubt belong to the species *Gryphaea angulata*.

Ranson (1948a) has given some preliminary details on the geographical distribution of oysters, a full account of which will be given later. Of special interest are his findings that *Gryphaea angulata* and *Gryphaea gigas* resemble each other so very much, even in the features of the larval shell, that Ranson is inclined to consider them as identical. It is not certain that *Gryphaea angulata* has lived on the coasts of Portugal and Spain since time immemorial, for according to Ranson the finding of a shell in a Gallo-Roman kitchen midden near Jarnac is controversial. We can, however, hardly believe it possible that *Gryphaea angulata* was transported from Japan to the Portuguese coast by man more than a thousand years ago. Rearing experiments will teach us some day whether *Gryphaea gigas* and *Gryphaea angulata* are really identical, or whether they merely resemble each other very much. Ranson has further claimed that *Ostrea chilensis* occurs both in New Zealand waters and on the coasts of Chile and that *Ostrea folium*, *Gryphaea cucullata*, and *Pycnodonta cochlear* are very widespread and occur in the Atlantic, Pacific, and Indian Oceans. Ranson found *Pycnodonta* collected in Atlantic waters stored in collections under other names (Ranson, 1941a). We have already discussed his views (1949a, 1951c) on the distribution of *Gryphaea margaritacea* along the South African coast. More evidence must be collected before we can believe that this species is not self-supporting there, but depends on larvae produced in the waters of Madagascar. According to Ranson (1951c) the only oysters occurring in South African waters are *Gryphaea margaritacea* and the small *Ostrea stentina* (syn. *O. algoensis*). I have, however, reasons for assuming that there lives also a larger type of flat oyster in these waters, and I would welcome irrefutable proof that the oyster of Fig. 5 of Ranson's paper is really *Gryphaea margaritacea*, and not an *Ostrea*.

Until the rather chaotic nomenclature of oysters is cleared up, it is difficult to appreciate the value of lists of species occurring locally, such lists as those of Poisson (1946) for the waters of Madagascar and Mauritius, of Parodiz (1948) for the coast of Argentina, and of Blanco, Villaluz and Montalban (1951) for the Philippines. Some evident cases of synonymy have been recorded, but the high degree of polymorphy of many oysters makes it very probable that there is good reason for suppressing more names. Unfortunately, only features of the adult shell are recorded in the list of Blanco, Villaluz, and Montalban (1951). Poisson (1946) also noted the color and taste of the soft parts, but no details were given on the anatomy or the features of the larval shell, which should be considered as crucial characteristics.

Gunter (1951a) lists as species of oysters living in the Gulf of Mexico, Caribbean, and West Indian region *Pycnodonta thomasi*, *Ostrea equestris*, *O. frons*, *O. permollis*, *Gryphaea* (*Crassostrea*) *virginica*, and *G. rhizophorae*, and has discussed taxonomical and zoogeographical details. He suppresses the names "O. limacella" and "O. spreta". Gunter (1951a, b) recorded the finding of *Ostrea frons*, *Ostrea equestris*, and *Gryphaea virginica* on the submerged parts of an oil well platform off the Louisiana coast. He further found both *Ostrea*

equestris and *Gryphaea virginica* on the templates of an oil well platform off the Texan coast.

Schuster (1949) complained that it is difficult to find out which species of oysters live in Indonesian waters, since the most recent general synopsis of the geographical distribution of the Indonesian lamellibranchs is said to be Rhumphius' book *De Amboinsche Rariteitkamer* (1705).

XXIII. DISEASES AND PARASITES

The heaviest blow dealt to the oyster culture and oyster fishery in Europe was the widespread and devastating mortality of *Ostrea edulis* in the years 1920 and 1921. Vast quantities of dead oysters appeared with relative suddenness on many French and British oyster parks and on many natural oyster beds, especially in France and England, but also in Germany, Denmark, and Holland. Many natural beds were virtually wiped out, and failed to recover later. Cerruti (1941) recorded a very serious mortality of *Ostrea edulis* in the Mar Piccolo near Taranto (Italy) in the year 1919. He assumed that oysters attached to the hulls of the many ships which sought shelter in these waters for prolonged periods at the end of the first World War may have brought the disease to England and France. The year 1920 and especially 1921 brought disaster there, but in some isolated places, such as the Heligoland oyster bank (Caspers, 1950) and natural beds on the north coast of Brittany, the mortality came several years later. Investigations to clear up the cause of the devastating mortality did not lead to clear results. There was at this time no fisheries biologist concerned only with shellfish, and Orton, who was in charge of the investigations in England, was able to begin only when the mortality was already on the decline. Fortunately his findings have been published in detail and may serve for comparison with later observations. Gaarder and Alvsaker (1941), who observed starvation among Norwegian oysters in years with too scanty sunlight, have suggested that a lack of food due to continued dark and rainy weather may have led to the serious mortalities among the oysters in Western Europe: "Die grosse Sterblichkeit unter den Bank-Austern in Westeuropa in den Sommern 1920 und 1921 lässt sich als eine Folge der Witterungsverhältnisse 1920–21 erklären." Spärck (1950b) concluded from the fact that there was a serious mortality in the oyster districts of France, England, Holland, Germany, and Denmark simultaneously that there can hardly have been an epidemic cause, much the less so "because the characteristics of the mortality show no indication at all of infection or parasitism." Spärck assumes that variations in ecological conditions, especially in summer temperature, may have caused a gradual decline, and even that the records of a serious and rather sudden mortality in the year 1921 are exaggerated.

I agree with Cole (1951) that the trustworthy records of the devastating mortality in 1921 make it impossible to accept such explanations. The data and figures presented by Dalido (1948) for the events in the Morbihan district (France) give a clear picture. It certainly has to be admitted that we do not yet know the cause of the 1921 mortality, and that there is good reason for the fear of the oystermen that a similar and equally devastating mortality may recur unheralded, but the little we know indicates that it was a real disease. I have reason to believe that more evidence will soon be presented [cf. Mackin, Korringa, & Hopkins, 1952: Hexamitiasis of *Ostrea edulis* L. and *Crassostrea virginica* (Gmelin), *Bull. Mar. Sci.* Gulf & Carib., 1: 266–277]. It is certainly difficult to accept the view that weather conditions were so abnormal all over Western Europe in the years 1919–1921 as to offer a plausible explanation for the serious mortality. The summer of 1919 was cold in Holland, but those of 1920 and 1921 gave water temperatures well above the average. I should also like to remind Spärck of the disease of the eelgrass, which not only wiped out in a very short time the *Zostera* beds of Western Europe, but also affected those on the Atlantic coast of Canada and the United States. The rapid spreading of this plague has never been used as an argument against its being caused by a disease.

There is another devastating rise in oyster mortality recorded—this time in *Gryphaea virginica*—of which the cause has not yet been determined. Needler (1941) and Needler and Logie (1947) described the events in the waters of Prince Edward Island (Canada). In the year 1914 oysters from New England waters were relaid in Malpeque Bay, P. E. I. A sudden increase in the mortality was recorded for this bay in the year 1915. In the following years the mortality spread gradually to neighboring oyster grounds, and eventually destroyed the fisheries in all the principal producing areas of Prince Edward Island. Maps are presented to show how the mortality

spread. Enmore River was reached in 1933 and the important Charlottetown area in the year 1936. The progressive nature of the mortality and the absence of any marked changes in the physical environment are evidence that the deaths were caused by a contagious disease. This view is supported by the fact that the high death rate always begins late in summer and then 90 to 99 per cent of the oysters die, irrespective of the type of bottom they are grown on, and under a variety of hydrographical conditions. Failure to grow, weakness of the adductor muscle, and the presence of many yellow-green pustules, up to ½ cm. in diameter, are characteristic symptoms of the disease. A very important observation is that the stock bred from the few survivors in the Malpeque area appeared to be resistant to later outbreaks of the disease, though transplantation experiments clearly demonstrated that the causative agent was still present and active there, for high proportions of oysters brought in from non-affected areas were killed. This is an interesting case of natural selection of oysters resistant to disease. Repopulation of the Prince Edward Island beds is based on the use of the new resistant stock. The hypothesis is advanced that the yet unknown causative organisms were brought in in 1914 with the U. S. oysters used for relaying, these presumably being already naturally resistant to the disease. The crucial experiment to demonstrate that U. S. oysters are resistant in P. E. I. waters has not yet been carried out; neither has it been stated how many of the oysters imported in 1914 were killed off in 1915. The disease has not yet been recorded from oyster beds in New Brunswick and Nova Scotia, and efforts are being made to prevent its spreading to this area. Though the causative microorganisms responsible for the disease have not yet been found, a detailed histopathological study should eventually reveal it. We should accept Needler's view that up till now very few diseases of marine organisms have been investigated in detail, though there is no reason to assume that contagious diseases are rarer in the sea than in fresh water or on the land.

A mortality of quite a different nature struck the Dutch oyster industry in the 'thirties, and continued to give cause for anxiety in the 'forties. Many oysters (*Ostrea edulis*) developed irregular green rubber-like spots and warts on the inner surface of the shell. Oysters with serious shell-malformations did not grow at all, and soon mortality rose to such an alarming level that the Dutch oyster industry saw itself threatened with extinction (Korringa, 1947a). It took many years of investigation, both in the field and in the laboratory, to unravel bit by bit the secrets of this once so mysterious disease. I gave a short account of this work at the Edinburgh Shellfish Meeting (Korringa, 1951c) and hope to present a detailed report later. Microscopical investigations revealed that the green warts in the shell are laid down by groups of tall, narrow cells, closely resembling those which produce the ligament in healthy oysters. An earlier phase of the disease appeared to be characterized by tiny specks of a chalky white color, usually found in thin, newly produced parts of the shell. Transplantation of pieces of healthy and diseased shell demonstrated that in this early stage of shell disease the causative agent is located in the shell itself. In due course it brings about locally irreversible changes in the mantle or muscle tissues, changes which lead to the formation of the green spots and other malformations of the shell. Shell disease appeared to spread during warm spells in summer. New victims appear after temperatures of 19°C have occurred for 10 days or longer; the higher the temperature after that critical period has elapsed, the more serious the new attack will be. Well-defined niduses of disease seemed to make their appearance year after year in the same places. The causative agent of shell disease is a fungus whose spores are distributed by the water currents. The germinating spores are able to perforate thin parts of the oyster's shell and proliferate upon reaching the interior surface of the shell. The fungus appeared to thrive in old green decaying shells, and it is such shells, mostly of *Cardium* and *Crepidula*, which appeared to abound in each nidus of the disease.

Oysters attacked by shell disease had earlier been found in the Dutch oyster district, but it was not until 1930 that this plague gave cause for serious anxiety. This outbreak could be explained by the enormous quantities of *Cardium* shells the Dutch oystermen scattered on their beds in the years 1920–1930. These shells greatly favored the development of the fungus mentioned above (Korringa, 1947a, 1951c). Conditions ameliorated when the oystermen began to place their tile collectors in the sites indicated as free of shell disease. But only a wholesale clearing away of old useless shells rendered the ecological conditions less and less favorable for the shell disease fungus. It also appeared to be feasible to destroy the fungus in

the early phases of the disease by bathing the infected oysters in a dilute solution of a mercury disinfectant. Large scale application of disinfection of young oysters led to the saving of millions from an untimely death and prevented the development of malformations in the shells. Technical details on a new disinfection technique, which also kills young slipper-limpets (*Crepidula fornicata*) on oysters and collectors have been given in Korringa, 1949b. Later (Korringa, 1951b) I informed the oystermen about the favorable results of the cleaning of the beds and insisted that they should go on dredging away old shells and disinfecting those young oysters which showed the early symptoms of shell disease. Shell disease occurs in Brittany (France), too, especially on or near beds where old decaying shells abound (Cole, 1950; Korringa 1951c).

Of great importance is the discovery by Mackin, Owen, and Collier (1950) that a microbial parasite of the oyster *Gryphaea virginica*, named *Dermocystidium marinum*, may build up massive infections in the tissues of its host. This pathogenic organism is believed to be a fungus, though the only known stages are small vacuolated cells, usually measuring 5 to 7 μ in diameter, which reproduce prolifically in the oyster's tissues by a process like schizogony, closely resembling that in certain sporozoans. Interesting histopathological details illustrated by photomicrographs, were presented by Mackin (1951). The disease brought about by this parasitic microbe strongly resembles human blastomycosis. A variety of tissues may be attacked, although the most usual site is the intestinal epithelium. There is no marked toxic action, since extreme concentrations of parasites may be built up before the host dies. The damage is largely caused by lytic action of the parasite's cells, coupled with embolism in later stages. Light and even very light infections, located in the intestinal epithelium, bring large numbers of phagocytes to the site of parasitic lodgment, a typical inflammation. Once the parasites reach the oyster's connective tissues they are distributed to other parts of the body through the blood sinuses. In due course enormous numbers of parasites and leucocytes may completely obliterate the oyster's circulatory system and obstruct all but the largest blood vessels. Circulatory failure is probably one of the most common immediate causes of the death of the host. Larger and smaller abscesses, the latter especially in the oyster's mantle, accompany the development. A typical pathogenic response is a marked fibrosis in many of the oyster's tissues, and an increase in the so-called pigment cells could be used as a valuable pathological indicator. Large numbers of parasites are ingested by the oyster's phagocytes, but these fall victim to their prey, which develops vigorously inside them. The infection progresses steadily, just as in human blastomycosis, so that it increases with the age of the oyster. Older oysters, especially, are subject to the mass mortalities this parasite may bring about in the waters of the U. S. Gulf Coast. Low temperatures retard the development of the infection. Mackin is inclined to believe that some mass mortalities among oysters elsewhere in the world may be caused by similar microbial parasites, which can only be detected by a systematic comparison of pathogenic conditions with normal tissues. Zenker's fixative fluid is to be preferred in preserving specimens to be used in such work. I know from my own experience how difficult it often is to interpret histological and cytological details of healthy and diseased oysters, and I fully agree with Mackin that a thorough and painstaking microscopical comparison of diseased and healthy tissues is required in the study of the oyster's microbial parasites, and that the devotion by many biologists of their chief efforts to environmental measurement without correlated pathological studies has often led to failure to recognize the true nature of the sudden increases in mortality among shellfish. Mackin is continuing his investigations on *Dermocystidium* and other microbial diseases, and we may consider his achievements a turning-point in the study of shellfish mortalities.

Prytherch (1940) described a sporozoan parasite of the American Atlantic oyster (*Gryphaea virginica*) as *Nematopsis ostrearum*. This parasite belongs to the Porosporidae, which pass part of their life history in decapod Crustacea, and another part in mollusks. Large numbers of spores of *Nematopsis* were found in various tissues of the oyster, but especially in the gill and the mantle. Some oysters appeared to lodge millions of spores. According to Sprague (1949), there are two species of *Nematopsis* in the oyster. The spores of *N. ostrearum* are to be found in almost any tissue of the oyster, except the digestive system, whereas the spores of *N. prytherchi* are located exclusively in the oyster's gills. Both Prytherch (1940) and Kudo (1939, 1946) claimed to have been first to describe the life cycle of *Nematopsis ostrearum*.

The xanthid crabs *Panopeus* and *Eurypanopeus*, common on many American oyster beds, appeared to harbor the heterogenic phase of *Nematopsis* in their intestinal tract. Crabs could be infected by feeding them oyster tissues containing the spores of *Nematopsis*. A description is given of the developmental stages inside the crab from the sporozoite to the gymnospores, of which one crab may release up to a million. The oyster is infected by gymnospores taken up with the feeding current. The oyster's phagocytes ingest the incoming parasites as a measure of defence, but the latter grow inside the phagocytes and ultimately pass into a resting stage, the thick-walled ovoidal spore, which remains somewhere in the oyster's tissues until the host dies. Xanthid crabs infect themselves by feeding on the dead oyster.

Prytherch found great numbers of *Nematopsis* spores in oysters taken from beds in Virginia and Louisiana where mortality was very high, and did not hesitate to ascribe the deaths to this sporozoan parasite. In this connection his advice is to make an effort to eradicate xanthid crabs on the oyster beds (Prytherch, 1946a, b), because those are the primary hosts of *Nematopsis* and transmit the parasite from dying to healthy oysters after a tremendous reproduction of the infective stages in the crab's intestines. Later investigators demonstrated, however, that Prytherch was too hasty in his conclusion that it was *Nematopsis* which caused the mortalities he observed. Galtsoff, Chipman, Engle, and Calderwood (1947) found *Nematopsis* from Delaware Bay (N. J.) to Texan waters, and often in large numbers. *Nematopsis* had also been brought into Long Island Sound with oysters originating from Delaware Bay, but did not seem to thrive there. Heavy infections of *Nematopsis* were observed especially in the Texan waters, but no unusual mortality was observed among those oysters. In York River (Virginia) the infection with *Nematopsis* was rather light; in upper York River, where many oysters died, the infection was even very light. Galtsoff could not find a correlation between the condition of these oysters and the rate of infection with *Nematopsis*. He stressed that only the inactive encapsulated spores of *Nematopsis* occur in the oyster, and that he could not find any indications of inflammatory or other pathological processes associated with the occurrence of *Nematopsis*. This has been fully confirmed by Landau and Galtsoff (1951), who sampled many oyster bars in the Chesapeake area. *Nematopsis* appeared to be widespread in these waters irrespective of the differences occurring in salinity. From 0 to 3546 cysts of *Nematopsis* per cm.^{2} of mantle tissue were counted. The intensity of infection of individual oysters appeared to be cumulative and therefore increases with the oyster's age. *Nematopsis* spores remain in the oyster until the latter dies. Very young oysters are still practically free of *Nematopsis*. No inflammatory reactions were noticed in the tissues surrounding the spores, and though very large numbers are often found in the interstitial spaces between the oyster's connective tissue fibers, they apparently did not interfere with its normal functioning. Mention is made of extremely heavy infections with *Nematopsis* spores in oysters collected by Engle at Cedar Points Reef (Alabama) in 1945. Though cysts were so abundant in the gills of these oysters that they completely obscured the tissues and clogged the water tubes of the gills, there was no unusual mortality among the oysters. Owen, Walters, and Bregan (1951) came to similar conclusions. They compared the incidence and degree of infection by *Nematopsis* in Louisiana and Florida waters with oyster mortalities in the years 1947 and 1948. There appeared to be a complete lack of correspondence between the numbers of *Nematopsis* spores and the index of condition computed for these oysters. Where serious mortalities did occur, the infection with *Nematopsis* was considerably lighter than in regions where oysters did not die in unusual numbers. If we agree that the spores of *Nematopsis* are inactive and do not harm the oyster, we may wonder whether the active development of the newly arrived parasites inside the oyster's leucocytes, just prior to the formation of cysts, could not produce ill effects or even death. Since Owen mentions, however, that Sprague informed him that experimentally produced infections incomparably more intense than anything seen in nature do not show conclusively that *Nematopsis* can be harmful to the oyster, we feel sure that Prytherch was wrong in ascribing several cases of serious oyster mortality to this parasitic sporozoan. If we read Prytherch's 1940 paper and compare it with Mackin's investigations on *Dermocystidium marinum*, we feel sure that Prytherch witnessed a mortality caused by *Dermocystidium* and described several of its characteristic symptoms, but was led astray by the simultaneous occurrence of the harmless but conspicuous spores of *Nematopsis*.

Parasites of larger dimensions may also attack the oyster. Odlaug (1946) studied the influence which the parasitic copepod *Mytilicola orientalis* exerts on the Olympia oyster, *Ostrea lurida*. This intestinal parasite appeared to be more numerous in mussels (42–74% infected, 3 to 5 per mussel) than in the oysters (2–9% infected, 1 to 3 per oyster) in lower Puget Sound, which indicates that *Mytilicola* does prefer the mussel to the oyster as a host. Even oysters infected with small numbers of *Mytilicola* appeared to have a lower index of condition than uninfected oysters, which demonstrates the harmful influence of this parasite. Odlaug's remark that the oyster's spawning activities bring about a still greater reduction of its index of condition does not refute the conclusion that *Mytilicola* is injurious to it.

From Cahn's account of the Japanese oyster literature (1950) we learn that Fujita (1943) mentioned *Protaeces ostreae* as a parasite of *Gryphaea gigas*. About 10 per cent of the oysters of Hiroshima Prefecture are said to be infected by this parasite, which is visible as oblong elliptical white areas in the oyster's gonadal tissues. The oyster is an intermediate host of this parasite; the adult phase is to be found in the fishes *Pagrosomus major* and *Epinephetus akaara*. Cahn did not mention the possible ill effects which this parasite might have on the oyster.

Schuurmans Stekhoven (1942) wrongly assumed that some nematodes might endanger the oyster's well-being, for he erroneously stated that these nematodes had been collected inside the oyster's valves. As a matter of fact, I had found them on the external surface of the shell of *Ostrea edulis* and they cannot be considered as parasites.

Mattox (1949) mentioned that he found in Puerto Rican waters an unidentified podocorynid hydroid living attached to the mantle and oral palps of *Gryphaea rhizophorae*. He assumed that the hydroid is a commensal rather than a parasite.

The difference between a commensal and a true parasite may, however, be rather vague and arbitrary. This can be concluded from the paper of Stauber (1945) on *Pinnotheres ostreum*. This little crab is only occasionally found on the gills of *Gryphaea virginica*. A sudden and alarming numerical increase of *Pinnotheres ostreum* was observed in Delaware Bay in the year 1941. The adult crab is found on the oyster's gills, facing the incoming current. It does not mind being upside down for prolonged periods. *Pinnotheres* does not take the food rejected by the oyster's palps but it does take the oyster's newly collected food by reaching beneath its abdomen with its claws, and also by disengaging the tangled masses of mucus and food caught in its legs. This form of robbery also leads to considerable injury of the oyster's gills in the place where the crab is situated; apart from an extensive shortening in height of one or more demibranchs, the edges of the oyster's gills become eroded and show a marked thickening. The transportation of food along the marginal furrow of the gill may be interrupted at such points. The injury to the oyster's gills and also the fact that oysters with crabs are weaker during exposure to the air than uninfected oysters, made Stauber conclude that *Pinnotheres* is not just a commensal, but a real parasite. The 1941 outbreak of *Pinnotheres* in Delaware Bay presented an opportunity to collect more information on the habits and morphology of this crab. Stauber described all parasitic stages in detail, many for the first time. The first parasitic stage is in both sexes hard-shelled and relatively flat and hairy. Subsequent stages have a membranaceous yielding carapace, slender legs, and a more rounded body form. In the years 1941 and 1942 some lots of oysters in Delaware Bay, heavily infected with *Pinnotheres*, showed an unusual mortality which Stauber tentatively ascribed to the detrimental effect of *Pinnotheres* on the oyster's gill and on its food collecting. In 1941 about 90 per cent of the Delaware Bay oysters contained 4 to 6 crabs in the first parasitic stages. It was observed in an aquarium how the small crabs find and enter an oyster. In 54 per cent of the oysters in a sample collected in 1942 Stauber found more than 10 small crabs per oyster, in some oysters over a hundred, the highest figure being 262 crabs in an oyster measuring 85 x 46 mm. In such cases the crabs are found not only on the oyster's gills, but also in the promyal and suprabranchial chambers. Stauber notes that crabs of different developmental stages may be found together in one oyster, but that he never found 2 or more female crabs in the third, fourth, or fifth stage in one oyster. The *Pinnotheres* population in Delaware Bay had already decreased in 1942—25 to 30 per cent of the oysters being then infected, predominantly with crabs of the fifth stage—and still further in later years. No explanation could be offered for the most unusual numerical increase in the year 1941. According to Poisson (1946), specimens of *Ostrea vitrefacta* (Madagascar) containing a *Pinnotheres*

invariably appeared to have developed a characteristic irritating flavor. He wondered whether this phenomenon could be associated in some way or other with the *Sertularia* he often found on the shells of oysters containing *Pinnotheres*. Consumption of such oysters easily lead to light attacks of nettlerash. This information resembles strikingly the popular belief (in Holland) that *Pinnotheres pisum* is responsible for cases of nettlerash brought about by consumption of mussels (*Mytilus edulis*). We have never noticed a special flavor of mussels containing *Pinnotheres*, and do not believe that *Pinnotheres* has anything to do with the allergic reaction some persons show after eating mussels. It would therefore be interesting to hear about possible associations of *Pinnotheres*, irritating flavor and nettlerash in other species of oysters.

Sandoz and Hopkins (1947) filled the gap in our knowledge of the early development of *Pinnotheres ostreum* by rearing its larvae in the laboratory. There appeared to be four zoea stages and one megalopa stage. The first crab being only 0.6 mm. wide, the authors conclude that at least one more instar must intervene before *Pinnotheres ostreum* reaches the "first stage" described by Stauber as the youngest crab which invades the oyster. According to Sandoz and Hopkins, about 30 to 40 per cent of the Virginia oysters are infested by *Pinnotheres*, but very rarely (in 5 out of 276 infested oysters) did they find more than one female crab in an oyster. This corresponds with Stauber's observations. Infested oysters appeared to be in poorer condition than non-infested oysters but there was no evidence of oyster mortality traceable to crab infestations.

XXIV. PREDATORS

Crabs larger and more voracious than *Pinnotheres*, may destroy great numbers of oysters in a more direct way. Lunz (1947) observed how the blue crab, *Callinectes sapidus*, holds an oyster in one claw and cracks off the edges of its shell with the other. Young oysters measuring from 5 to 30 mm. are an especially easy prey for the blue crab. Lunz had reason to believe that in South Carolina waters oyster mortality from the depredation of crabs is greater than from all other causes combined. Lunz's advice was to keep young oysters in fenced-in pens in order to protect them against the voracious crabs. Carriker (1951b) has confirmed Lunz's observations on the technique used by the blue crab. Though the blue crab is able to feed even on the thick-shelled *Venus mercenaria*, it is said to show a preference for mollusks with thinner shells. Baughman and Baker (1951) mentioned the stone crab *Menippe mercenaria* as a serious predator on oyster beds.

Carriker (1951b) has given an interesting description of the way gastropods of the genus *Busycon* force open the shells of tightly closing bivalves like *Venus*, *Gryphaea*, *Modiolus*, and *Mytilus*. Aquarium observations demonstrated that *Busycon* is attracted by the water pumped from the exhalent siphon and may thus detect even well-buried bivalves. To open the resistant shell of *Venus mercenaria*, *Busycon* holds it in the hollow of its foot so that the ventral edges of the valves lie directly under the outer lip of the gastropod's shell. Next it brings the margin of its own shell to bear on the slight depression at the junction of the valves an presses against the valve farthest away by strong contractions of its columellar muscle. Thus *Busycon* manages to chip off a portion of *Venus*' shell, then relaxes a moment and so continues the chipping until there is an opening sufficiently large in size to permit the gastropod to wedge the margin of its own shell between the valves of its prey. Further destruction of the bivalve's shell is a fairly easy matter. In the laboratory one large *Busycon* ate 0.84 oysters per week at 18 to 20°C and 2.7 per week at 20 to 24°C.; or 0.86 quahogs (*Venus mercenaria*) per week. Field experiments demonstrated that *Busycon canaliculata* and *B. carica* do feed on *Venus* and oysters, but prefer the thin-shelled *Modiolus*—which is a rather easy prey—when living among a mixed bivalve population. There is every reason to keep an eye on *Busycon* in oyster districts where they are abundant, and to instruct the oystermen to destroy them whenever they catch them in their tongs or dredges.

The predatory gastropods commonly known as drills use quite a different technique to open oysters and other bivalves. They drill a hole right through the calcareous shell, probably entirely by mechanical means and without making use of any acid secretion (Jensen, 1951a, b), and then insert the probiscis into the bivalve's soft parts. One of the worst drills is *Urosalpinx cinerea* from the American Atlantic coast. Mackin (1946) has noted that this drill may kill a great many young oysters, but that its activities are curtailed rather abruptly at a certain distance above low tide (1 to 2 feet). Adams (1947) studied the depredations by the drill on the

oyster beds of the Canadian Atlantic coast, and concluded that a mortality of about 30 per cent may be caused by drills in Malagash Bay. Reproduction of *Urosalpinx* starts here at water temperatures of about 20°C., and each female may produce up to 67 egg capsules per season, each containing 8 or 9 eggs. When the young drills hatch after 6½ to 8 weeks, they may start to feed on the newly settled oyster spat. When they stop their depredations in the colder season, they measure 1½ to 2 cm. Medium-sized drills have been found by experiment to kill 2-inch oysters at a rate of one every 3 weeks, but considerably greater numbers when small oysters are given. If oysters are absent they feed on mussels and barnacles. As *Urosalpinx* has no free swimming larvae, it is worth while preventing their spreading with oysters for relaying to districts where drills are rare or non-existent. Adams stated that trapping and dredging were unsuccessful as methods of control in Malagash Bay. Handpicking, though laborious, appeared to be more efficient, especially when carried through before egg-laying begins.

Urosalpinx was accidentally brought to England with American oysters, and is now a serious pest on the Kent and Essex oyster beds. Formerly the "native" drill, *Ocinebra erinacea*, coexisted with the American drill on these beds, but according to Cole (1942b, 1951) the former has been eradicated completely in recent years by hard winters, so that *Urosalpinx* is now the only drill threatening the English East Coast oyster industry. The damage done is greater than many oystermen think, since the drills attack mainly small spat up to thumbnail size so that much of the damage passes unrecognized. Cole stated that 75 per cent of the oyster spat may be killed by drills on Essex oyster beds during their first year. Losses due to drills are said to be rare in oysters over 2 years old. According to Cole, *Urosalpinx* is active at temperatures above 11 to 12°C. Observations on 3- to 8-year-old drills over a period of 100 days demonstrated that they devour from 0.332 to 0.481 one-year-old oysters per day, with a peak of 0.90 per day in August, or 0.03 two-year-old oysters per day. Newly hatched drills devoured 1.39 young oysters of 3 to 7 mm., per day. This demonstrates that newly hatched drills may cause extensive havoc among newly settled oyster spat. *Urosalpinx* grows slowly. Specimens one year old measure 2 cm., those two years old 2.5 cm., and those three years old, 2.7 cm. Ten-year-old drills measure about 3.9 cm. and then grow only 1 mm. per year. *Urosalpinx* is difficult to control on oyster beds, especially because the two-year-old drills, which already reproduce, are still small enough to escape through the meshes of the usual oyster dredges. That larger drills can easily be caught with a dredge became apparent when a bounty was paid for them. Early in the season almost equal numbers of male and female drills were caught. Later, when the female drills crawl on all kinds of objects to deposit their eggs, the catch consisted of about 90 per cent female drills. Peculiarly enough, the sex ratio was found to be normal again in the next spring, though neither significant migration nor sex-change occur. An explanation of this might be that the drill control was inefficient. Drill traps were found to be inefficient on Essex oyster beds, for the density of drills in the traps did not differ noticeably from that on the surrounding bottoms. Cole advised the establishment of barriers of clean mud bottom around well cleaned beds. Powerful hydraulic oyster dredges like those constructed recently in the United States could serve to clear away the drills efficiently, but such equipment is unfortunately extremely expensive.

Urosalpinx has also been introduced with Atlantic oysters to the waters of the Pacific coast of the U.S. (Puget Sound). A "native" drill, *Thais lamellosa*, already occurred there, and later a third drill, *Tritonalia japonica*, was brought in with Japanese oysters. Chapman and Banner (1949) studied the depredations inflicted by drills on populations of *Ostrea lurida* in Puget Sound. They collected quantitatively drills, living oysters, and the empty shells of oysters which had recently died, of which the last were scrutinized for drill holes. They concluded that drills do not form an important cause of mortality among the Olympia oysters at the present time, though some beds in Samish Bay are said to be abandoned because of the drill's heavy depredations. Both Cole and Adams demonstrated that much damage may pass unrecognized because small spat may constitute the drill's chief prey. This makes us wonder whether Chapman and Banner, who did not concentrate on oyster spat, did not underrate the losses caused by drills. According to Chapman and Banner, both *Thais lamellosa* and *Urosalpinx cinerea* prefer mussels to oysters as food. Cole found, on the other hand, that *Urosalpinx* definitely prefers oysters and barnacles to mussels, and one-year-old oysters to those of two years. In this respect it is

interesting to note that Engle (1942) found that *Urosalpinx* in captivity grows excellently on a diet of *Mya arenaria*, and well on a diet of oysters. If the drills were fed with *Balanus* exclusively they grew slightly less than those living among plenty of oysters. Poor growth was recorded for *Urosalpinx* fed on *Mytilus*. Engle's observations on mussel beds demonstrated that very few mussels were killed by drills there, while young oysters attached to rocks or shells of living and dead mussels were readily eaten. Large numbers of barnacles were also destroyed. It may be that Chapman and Banner founded their conclusions too much on attacks made on older oysters only. We can hardly suppose that *Urosalpinx* has changed its food habits after its introduction into Puget Sound.

Tritonalia japonica appeared to eat oysters almost to the exclusion of mussels, and only rarely attacked *Crepidula fornicata*, which abounds locally in Puget Sound. Chapman and Banner, therefore, concluded that most of the damage done by drills in Puget Sound must be ascribed to the activities of *Tritonalia*. The Japanese drill shows no tendency to climb, in the reproductive season, but deposits its eggs on the undersides of objects, preferably under the shells of *Gryphaea gigas*, which the oystermen often use as cultch. The egg cases of all three species of drills are described in detail. Though the egg-cases of *Tritonalia* contain up to 1500 eggs (which is 50 times as many as in *Thais*, and 200 times as many as in *Urosalpinx*), it is exceptional for more than 3 young drills to emerge from one case. Fortunately there is no pelagic phase, and experiments with colored drills demonstrated clearly that they do not move about to any great extent. Feeding experiments demonstrated that a *Thais* eats 0.5 oysters per month, and a *Tritonalia* 2 to 2½. We presume that these figures hold good for larger oysters. *Tritonalia* appeared to be more readily killed by low salinities than the native drill *Thais lamellosa*.

A closely related species, *Thais haemastoma*, plays havoc on many oyster beds along the Gulf Coast. According to Baughman and Baker (1951), this drill generally attacks small oysters, and usually perforates the thinner parts of the shell, close to the edge. Engle (1945) even claimed that this drill is the most persistent oyster enemy in Alabama waters. Its tendency to climb in order to deposit the egg cases makes it possible to catch and destroy both the drills and their eggs, but unfortunately such a system of control is laborious and expensive (Baughman and Baker, 1951). Engle also recorded that the drumfish *Pogonias* may destroy numerous planted oysters in Alabama waters, but that they do not damage the clustered oysters of natural reefs. In Texan waters large drums are said to be rare nowadays, so that damage done is of limited importance (Baughman and Baker, 1951).

Rapana thomasiana is a very big drill which is found on many Japanese oyster beds. It drills its holes in the margin of the oyster's shell, and is especially active in the warmer season (Suehiro, 1948). According to Ota (1946), it is possible to protect oysters grown by the "umbrella" type of oyster culture against the attacks of *Rapana* by means of a special guard of metal on the underside of the supporting poles. Suehiro (1948) described how *Rapana* with its soft foot is unable to climb over a spiny object like a chestnut-bur clasped over ropes and poles.

Other notorious predators are the starfishes. In Canadian waters it is *Asterias vulgaris* which preys on the oyster beds. This starfish does not occur in any considerable numbers above low tide level, and cannot stand water temperatures above 25°C. According to Needler (1941a), it may kill as many as 3 oysters half its own diameter in one week, but it is not able to overcome oysters over two-thirds of its own diameter. Needler stated that the young starfish settle after a pelagic life of about 3 weeks, and are big enough to kill oyster spat of the same year. By placing collectors rather late, the Canadian oystermen can avoid the settlement on them of large numbers of young starfish. Smith (1940a,c) studied the movements of *Asterias vulgaris* and found that these were neither fast nor extensive. Starfish colored with vital stains showed a random migration, and were mostly caught within 20 yards of the place of liberation, the greatest distance recorded being 200 yards covered in 4 months. Smith has claimed that starfish will move directly towards and not away from concentrations of oysters less than 40 feet away. Investigators working with *Asterias forbesi*, the American starfish, claimed earlier that this species must be very close to its prey before it moves directly towards it. This discrepancy requires further investigation. It seems difficult to understand how starfish could be guided by olfactory stimuli over considerable distances in tidal waters, where the currents change direction well before the slowly moving starfish can have reached its prey. The Dutch oystermen claim that

occasionally they see great numbers of the starfish *Asterias rubens* floating on the surface; a gas bubble has for some reason developed inside them and keeps them afloat. The Dutch oystermen believe that starfish can thus migrate to other feeding grounds (Korringa, 1946c), but there is no scientific evidence to support that view, and it is possible that the floating of starfish is abnormal. In his 1940a paper, Smith has informed us that *Asterias vulgaris* spawns late in May or early in June. There is a relative constancy of the date of spawning, which indicates that water temperatures may not be all-powerful in determining its start. At the end of one year *Asterias vulgaris* is said to be about 3½ cm. in diameter, and after two years about 6 cm. From 2 to 6 starfish of 6 to 7 cm. may occur per sq. meter on the Canadian oyster beds, and up to 15 of 3 to 4 cm. diameter. Salinities of 14 ‰ and lower cannot be endured, and such may be the cause of winter mortality under the ice in shallow water.

Experiments on the efficiency of mopping have been described by Smith (1940d) Colored starfish were used in these experiments. Small specimens under ½ inch are not caught by mopping. Of 1600 starfish scattered on 1/20 acre, 50 per cent were caught by mopping within 2½ hours; after 12 hours, 72 per cent were recaptured. Of 3000 starfish scattered on 1 acre, 30 per cent were caught in the first 3 hours of mopping, and 86 per cent after 28 hours. It was impossible to recapture all of the scattered starfish, presumably because many may be destroyed by mechanical injury. Smith assumes that 99 per cent of the starfish have been killed when the last hour of mopping brings up less than 2 per cent of the number originally present. Mopping being a laborious and therefore expensive method of control, other methods are sought. Needler (1940a) has advised applying with a fertilizer spreader about 500 pounds of finely granulated quicklime per acre of oyster ground. This is said to be enough to kill the vast majority of starfish without injuring shellfish or crustaceans. So far as we are aware, quicklime-spreading has not yet been adopted as a method of starfish control by the Canadian oystermen.

On the oyster beds of the Atlantic coast of the United States, it is *Asterias forbesi* which often plays havoc among the oysters. Loosanoff and Shipley (1947) tried to find out whether or not this starfish is guided by olfactory stimuli in its search for food. They found that chemotropic reactions are not of primary importance, and that this starfish finds its food by accidental contact while moving on the bottom of an experimental tank. That it was not a lack of water currents in the tank which was responsible for this result can be concluded from field experiments with traps provided with different types of lure. The catches clearly demonstrated that this starfish does not show a preference for baited traps, even when oysters are put in them. Investigations on the effect of reduced salinities on *Asterias forbesi*, which occurs naturally in salinities from 18‰ to 32‰, were carried out by Loosanoff (1945a). Very low salinities could be endured for a few hours, but salinities under 18‰ had in the long run injurious effects on the starfish; the lower the salinity, the shorter the period it could be endured. At a salinity of 16‰ the starfish survived for 32 to 63 days, but at 18‰ Loosanoff could keep the starfish in apparently perfect condition for a very long time.

Loosanoff and Engle (1942b) recommended chemical control of starfish by spreading finely granulated quicklime, at about 500 pounds per acre which brings about rapidly spreading lesions in the delicate skin membrane of the starfish, and ultimately leads to the death of this voracious echinoderm. Experiments on beds at depths of 18 to 40 feet demonstrated that a high percentage of the starfish may indeed be killed this way, even at low water temperatures. So far, lime-spreading is not a commonly adopted technique of starfish control in U.S. waters; only mopping seems to be used on a very large scale. I can hardly believe there is difficulty in obtaining the required equipment which prevents lime-spreading from being generally adopted by the Long Island Sound oystermen, as Lee (1948a) asserted. He discussed the damage done by starfish and reckoned it at over $1,000,000 per year, the expenses for control measures included. Lee has advanced once more the classical view that starfish open oysters and other shellfish by merely exerting a steady, prolonged pull with their ambulacral feet, and rejects the hypothesis that the starfish possesses some secretion which paralyses the bivalve. In my opinion the short time required to open a mussel, as well as the lack of leverage, and the poor supporting skeletal structure in the starfish render it doubtful whether its steady pull is really so powerful (Korringa, 1946c). The problem of how starfish open

bivalves certainly deserves a new, unbiased experimental approach.

The high cost of starfish control makes it worthwhile to look for some use for those brought ashore. Lee (1948b,c,d,e), therefore, carried through some technological studies, and found that a difficulty in the use of starfish meals in the diet of domestic animals is the presence of a thiamine-destroying enzyme called thiaminase. This enzyme is found also in the intestine of some fish, and has occasionally caused losses in fish hatcheries and fox farms. However, at tne temperatures commonly used in dryers in the commercial production of protein meals, the thiaminase is almost completely destroyed. Even so, it is advisable to add only low percentages of starfish meal to commercial mash formulae, because of its high calcium content. In Holland the mussel- and oyster-farmers are paid by the producers of protein meals for the starfish they bring ashore.

Burkenroad (1946) wondered whether efforts to control starfish are not a waste of money, since fluctuations in their abundance are said to be entirely governed by natural conditions. I have remarked earlier (Korringa, 1951f) that such a suggestion, which might dishearten the oystermen who go to considerable expense to control starfish is inexcusable if not based on solid facts. I agree that natural factors may govern to a high degree the success or failure of starfish reproduction, but our experience in Holland demonstrates very clearly that the control of starfish can be very efficient indeed. Difficulties encountered in the last year of the war made this very plain. The Dutch shellfish farmers clear away the starfish from their mussel and oyster beds whenever necessary, by dredging, culling the catch aboard, and replanting the mussels or oysters on a clean plot. Depradations by starfish are thus brought down to an insignificant level.

XXV. COMPETITORS

The polychaete worm *Polydora* is often mentioned in oyster literature because of its close association with oysters, often leading to noticeable damage. The *Polydora* associated with oysters on the Atlantic and Gulf coasts of North America are recorded under different names, but since it is very probable that practically all of them belong to the species *Polydora websteri* Hartman, we shall use only that name here. A rather exceptional case is, however, the 1940 *Polydora* plague in Delaware Bay, described by Nelson and Stauber (1940). Though in this case, too, *Polydora* were found to occupy blisters on the internal surface of the oyster's shell—as described in greater detail below —most of them were found to infest the external surfaces of shells of living oysters. Nelson and Stauber recorded that the second type of *Polydora* copiously secreted strands of thick mucus to form a network which caught sediment, detritus, oyster feces, and rejected material. Decomposition of this mass covering the oysters is said to have produced so much hydrogen sulfide that it finally led in early spring to an oyster mortality sweeping over acres of the Delaware beds. This record differs so much from the usual attacks of *Polydora websteri* that it seems not improbable that it was another species of *Polydora* which was to blame. Or should we accept the opinion of Mortensen and Galtsoff (1944) that infestation of oysters by *Polydora* may be a purely accidental phenomenon, and that the worms normally live on mud bottoms, where they gather and deposit huge quantities of detritus? The observation that adult *Polydora* did not try to enter oysters under laboratory conditions is certainly not decisive, since only experiments with very young *Polydora* bred from adults living in oyster shells can lead to irrefutable conclusions.

It also seems rather surprising that in the case described by Nelson and Stauber (1940) decomposition of the collected detritus led to heavy mortality in the colder season. We wonder whether a secondary infection with microorganisms could possibly have been involved.

Lunz (1941) described the more classical attack of the true *Polydora websteri*. This worm selects the shell of the oyster as a habitat in which it finds protection. The young *Polydora* crawls in between the mantle and shell of a living oyster, settles close to the outer edge of the shell, and collects a blob of mud around itself within a few hours. The oyster responds by covering this undesirable material with a membrane of conchyolin, and covers this later with nacreous material, thus constructing for *Polydora* a solid abode, directly communicating with the surrounding sea water. Polydora is able to enlarge its burrow in due course by etching out the calcareous material of the shell. This formation of mud blisters reduces the volume of the shell cavity, and forces the oyster to devote much more of its energy to shell secretion than would otherwise have been necessary. It is therefore not surprising that Lunz found that heavily infected

oysters were often in poor and watery condition. Oysters with mud blisters have moreover an unpleasant appearance and are commercially not readily saleable. Grice (1951) made a closer study of the activities of *Polydora websteri* in South Carolina waters by analyzing monthly samples of oysters. Below low water mark about 54 per cent of the oysters had mud blisters, but above low water mark Grice found that only about 20 per cent were infected. These percentages did not change materially with the seasons. The percentage of oysters bearing mud blisters appeared to increase with the size of the oyster. Grice expected an increase in the number of blisters per oyster proportional to the increase of available surface area of the shell, but the data collected did not support this view. Since *Polydora* always settles on the margin of the oyster's shell, it is however, not the number of square inches which determines the available space for *Polydora* but the length of the circumference of the shell, which one would expect to be proportional to the number of mud blisters. If we recalculate Grice's data on this assumption, we do find an almost complete correlation between the shell's circumference and the number of *Polydora* burrows. We regret that Grice counted only the mud blisters and did not ascertain whether or not living *Polydora* still occupied them (e.g., by holding the shell against a powerful lamp), for this would have explained something of the life cycle of *Polydora* in South Carolina waters. The correlation discussed above suggests that it is an equal number of generations of *Polydora* which inhabited Grice's oysters, for otherwise he would have found a cumulative effect. Perhaps older and uninhabited blisters, situated farther away from the edge of the shell, were well covered with nacreous layers and were therefore not included in the counts.

Kavanagh (1941) reported the interesting observation that shells of *Gryphaea gigas* planted in Louisiana waters became much more heavily infested by *Polydora* than shells of *Gryphaea virginica* living in the same waters, a fact which he explained tentatively in terms of differences in shell closure in the two species.

Loosanoff and Engle (1943) carried through a series of experiments to determine the effect of *Polydora websteri* on the well-being of the oyster *Gryphaea virginica*. Oysters of several year classes grown in trays suspended from a float in Milford Harbor from April, 1940, to November, 1942, became heavily infested with *Polydora websteri*, much more so than oysters living on the muddy bottom of Milford Harbor. The oysters in the trays were so heavily infested with *Polydora* that several vesicles combined to form large mud blisters, and up to 6 or 7 blisters were found superimposed upon one another. The occupants of the upper blisters were often very small, and had apparently entered the shell a short time before. In vigorous oysters the worms are only for a very short time in direct contact with the mantle, and are so soon isolated that they cannot exert a toxic effect. The blisters do reduce the volume of the oyster's shell cavity, and force the oyster to spend considerable energy in secreting shell material for covering the worms. As the oysters in the trays were in good condition at the end of the experiment, Loosanoff and Engle concluded that heavy infestations by *Polydora* do not prevent oysters from becoming fat. We should add that it is still possible that oysters living under less favorable nutritional conditions than those kept on the trays in Milford Harbor may suffer from heavy blistering.

Needler (1941a) recorded the same type of *Polydora* mud blisters from Canadian waters, and stated that the worms apparently do not usually kill the oyster or harm it very much. The market value of the blistered oysters is, however, reduced because of the disagreeable appearance of the shell blisters containing the worms. Medcof (1946b) made a closer study of *Polydora* in Canadian oysters and found a rather light infection in the Bras d'Or Lakes (25 to 75% infected, 1 to 3 per oyster), in New Brunswick, and in Prince Edward Island (0 to 30% infected, 1 to 2 per oyster). He confirmed the fact that such rather light infections do not noticeably decrease the oyster's condition, but that they do affect the market value because of the unappetizing appearance of the blisters. Medcof also found *Polydora* in oysters kept in trays and therefore concluded that it must be the free-swimming stage of *Polydora* which infects the oyster.

In European waters oysters may suffer from several kinds of *Polydora*. Mud blisters very similar to those found on the Atlantic coast of North America are produced by *Polydora hoplura*, which is especially abundant in several parts of the Brittany oyster district. *Polydora hoplura* has been brought repeatedly to Holland with French oysters for relaying (Korringa, 1951f, g), but is as a rule completely exterminated again by low water temperatures in winter. Survival of *Polydura hoplura* during mild winters caused a temporary outbreak of

this plague in the Oosterschelde in the year 1950. Peculiarly enough, *Polydora ciliata*, a smaller species of *Polydora* native to Dutch waters, became extremely abundant in that same year. *Polydora ciliata* does not crawl in between the oyster's mantle and shell, and does not make any mud blisters, but merely drills its U-shaped burrows all over the shell of the oyster, and at all possible angles to its edge. *Polydora* often lengthens its burrow by the construction of shorter or longer tubes of grey mud, which gives the shells of heavily infested oysters a "hairy" appearance. Shell perforations irritate the oyster, which responds by sealing off the threatened places with layers of conchyolin, which presumably requires considerable energy. Though both species of *Polydora* abounded in the Oosterschelde in 1950, *Polydora hoplura* was found especially on or near beds where French oysters had been relaid (Korringa, 1951g). *Polydora hoplura* has larger eggs and a shorter pelagic life than *P. ciliata*. The severe infestation with the two species of *Polydora* did lead to ill effects. Shells honeycombed by *Polydora ciliata* are brittle and break easily during transportation. Evidence can be adduced that oysters heavily infested by *Polydora* show a poorer growth than non-infested oysters on the same beds. Oysters, especially when they contained over 25 *Polydora ciliata* or over 5 *Polydora hoplura*, showed poor growth and were often leaner than non-infested oysters. It is more difficult to judge to what extent the oyster's defence measures against the intrusion of *Polydora* reduce its resistance to microbial infections and adverse conditions, but a higher mortality observed in the oysters heavily infected suggests that this effect should be taken into consideration. We have developed a good method of control. *Polydora* appeared to be killed off completely by bathing the oysters for 16 hours in fresh water or for 3 hours in ½‰ solution in sea water of the ammonium salt of dinitro-orthocresol. Oysters do not suffer noticeably from such treatments and soon showed better growth and whiter shells. Disinfection of all oysters for relaying brought in from regions where *Polydora hoplura* occurs is compulsory, now that this mud blister worm has disappeared again from the Dutch oyster beds. *Polydora ciliata* remains, but did not attack the shells of Dutch oysters to any considerable extent in the year 1951. The possible existence of two different races of *Polydora ciliata*, with a different mode of living, has been discussed in Korringa, 1951f.

Only a few recent papers deal with the boring sponge *Clione*, another serious competitor which locally may kill large numbers of oysters. Old (1941), who studied the taxonomy and distribution of the boring sponges of the Atlantic coast of North America, claimed that at least seven distinct species of *Clione* occur in this area. *Clione* is less tolerant of low salinities than the American Atlantic oyster, so that many important oyster beds in brackish water do not suffer from infestation by this notorious competitor. Though the boring sponge is not a true parasite, and excavates galleries in the calcareous shell of the oyster only to provide itself a suitable shelter, heavy oyster mortality is traceable to abundant infestation with *Clione*. Old presumed that physical exhaustion of the oyster from abundant shell secretion in its efforts to preclude penetration of the sponge reduces the oyster's natural resistance against pathogenic organisms and other dangers. Perforations under the muscle scar are especially difficult to repair and this may lead to imperfect closure, entailing a variety of dangers.

My own view regarding the effect of *Clione* perforations (Korringa, 1951f) corresponds closely to Old's conclusions. I assume that it is especially the deposition of conchyolin layers in places threatened with perforation which may exhaust the oyster. The effects of the activities of *Clione* on the oyster's well-being resemble strikingly those brought about by heavy infestations by *Polydora*. If *Clione* perforates the shell of the oyster, the latter dies. De Laubenfels (1947) has also pointed out the serious drain on the oyster's energy brought about by its continuous laying down of shell substance in order to avoid perforations by *Clione*. He agrees that serious oyster mortality can be caused by the activities of the boring sponge, though the latter is not a true parasite. From the observation that *Clione* can be killed by bathing the infested oysters for a short time in fresh water, and from the occurrence of a very abundant growth of *Clione* in fully oceanic conditions, Laubenfels concluded tentatively that *Clione* makes its excavations in the oyster shell as a measure of protection against low salinities, but I do not believe there is sufficient evidence to support this view. I presume that the factor of shelter predominates. De Laubenfels suggested that a dousing with fresh water would suffice to

free the infested oysters from the dangerous competitor. I doubt whether such a procedure would lead to satisfactory results. Bathing the infested oysters in fresh water for several hours (or in sea water containing a disinfectant) may yield better results. It is true that infestation may reappear when the treated oysters are planted anew on the *Clione*-infested beds they came from. If the treatment is, however carried through soon after the end of period of reproduction of the sponge, it seems possible that the oyster may get enough time to grow and fatten before new infestations attain dangerous dimensions.

In several oyster districts there is reason to fear another serious competitor, *Crepidula fornicata*, the slipper limpet. It is especially the British and Dutch oyster beds which suffer greatly from this competitor, originating from the American Atlantic coast. I have described earlier (Korringa, 1942) how *Crepidula* was brought to Europe and how it spread over many European oyster districts. I stressed that its method of reproduction, necessitating copulation, hinders unlimited extension of this species by means of free-swimming larvae, for successful settlement is only possible if two or more *Crepidula* settle in exactly the same place. The more the larvae are scattered, the smaller the chance that the young slipper limpet will be able to mate, even when there is a strong tendency for gregariousness in settling. Orton (1950) recently recorded the finding of solitary *Crepidula* bearing larvae. The shells giving no indication of having had other individuals attached to them, Orton deems it possible that self-fertilization may occur with sperm retained from the preceding male phase, and carried until the female phase is fully established. If this holds good, we have to revise our view on the spreading of *Crepidula* by means of free-swimming larvae, and on the establishment of new centers of distribution. We therefore agree with Orton that experimental evidence in this important aspect of the biology of *Crepidula* is very desirable indeed.

Crepidula may cross a limited area of unsuitable ground by means of pelagic larvae, but I do not believe that it crossed the North Sea this way. I presume that accidental transportation of groups of adult individuals caused the establishment of *Crepidula* in the Oosterschelde. In this particular case, I believe in the transportation of chains of slipper limpets attached to sea-weeds or floating pieces of wreckage rather than that *Crepidula* came in attached to the hull of a ship. This seems more probable because there are no shipbreaking yards near the Dutch oyster district and because the frequent inspection of coasters visiting the Oosterschelde did not lead to the discovery of a single *Crepidula*. I do agree, however, with Cole (1951) that *Crepidula* may be transported on the hulls of heavily fouled ships. In this respect shipbreaking yards are especially notorious as a focus for the spreading of new organisms.

The reason why *Crepidula*, after its arrival in the Oosterschelde, increased so enormously in numbers that it really threatened to oust the oyster was that conditions were so extremely favorable for the establishment of *Crepidula* beds, since many of the Dutch oyster beds were completely covered with *Cardium* shells scattered as collectors in the years 1920–1930. Where suitable substrata are less abundant, *Crepidula* does not easily become a real oyster pest, e.g., on well-cleaned oyster beds in the Oosterschelde, on oyster beds in the Dutch Waddenzee, and in many a secondary focus of spreading. Cole (1951) has also noted that it is not impossible to maintain thoroughly cleared beds reasonably free from slipper limpets. *Crepidula* is steadily extending its range in Western Europe. Orton (1950a) recorded its arrival in Lyme Bay, east of Plymouth, and Cole (1951) mentioned its recent arrival in the Fal and Helford rivers, where the Falmouth dockyards may have served as the focus of spreading. Werner (1948a) has described in detail how *Crepidula* was brought to German waters with Dutch oysters for relaying, and how its pelagic larvae caused a further spreading and in due course the establishment of new populations. In severe winters *Crepidula* may be destroyed on tidal flats in German waters, as it has been in Holland (Korringa, 1942), but it rapidly spreads again from populations living in deeper water. Only where suitable collectors are abundant, as on many of the former natural oyster beds in the German Wattensee, may *Crepidula* build up really dense populations.

Orton (1950b) observed the pairing of *Crepidula* in the winter period in the Plymouth laboratory, and deems it probable that pairing occurs generally in late autumn and early winter, as well as at other times, the female storing the sperm in the receptaculum seminis until spawning begins. According to Werner (1948a, b), *Crepidula* begins its reproduction when the water temperature rises above 6° to 7°C, and eggs in all develop-

mental stages may be found until the temperature drops again below that level at the approach of winter. Chipperfield (1951) found that spawning begins at about 10°C on the British East coast oyster beds, and comes to a virtual standstill long before the temperature drops below that level in autumn. He concluded that the length of the breeding period is determined rather by the rate of exhaustion of the gonads and the rate of regeneration of ova and sperm. Interesting is his finding of a marked tendency for a proportion of female *Crepidula* to spawn in concert in a manner unassociated with temperature or temperature fluctuations. This all resembles very closely our findings in *Ostrea edulis*. Werner described in detail how *Crepidula* deposits its eggs under its shell, 60 to 80 egg capsules at a time, each capsule containing some 200 to 400 eggs. During the 3 to 4 weeks of incubation (ca. 21 to 28 days at 10°–12°C, and only 10 to 14 days at higher temperatures, according to Chipperfield, 1951) the eggs change from a yellow to a brownish and finally to a blue-grey color. Then the veliger larvae escape to live for 10 to 14 days in the plankton. (Chipperfield, on the other hand, deems it possible that the planktonic life of *Crepidula* may last as much as 35 days!) At the end of its first year *Crepidula* measures 10 to 15 mm. in German waters, and at the end of its second year 20 to 30 mm. The size and shape of the shell of *Crepidula* are greatly influenced by the size and shape of the collectors on which it settles.

Spärck (1950a) discussed the spreading of *Crepidula* in the Limfjord (Denmark), where it arrived in 1934 attached to Dutch oysters for relaying. Though it extended its range steadily, especially after the favorable summers of 1943, 1945, and 1947, massive settlements like those described for British and Dutch oyster districts have not yet developed in the Limfjord, I presume because beds densely planted with suitable collectors are not available there. Any injurious influence on the local oyster fishery has not been observed. *Crepidula* found its way to Fanø in the Danish Waddensee and also travelled right through the entire Limfjord to arrive in the Kattegat during these years. Forsman (1951) has recorded that the first settlers have already arrived on the Swedish coast.

Just what makes *Crepidula fornicata* an oyster pest is discussed in Korringa, 1951d. Even in waters where dense populations of slipper limpets developed, tne oysters did not fail to grow and fatten. Chapman and Banner (1949) concluded from observations in Puget Sound, where *Crepidula* was introduced with oysters from the American Atlantic coast, that abundance of this gastropod does not necessarily interfere with fattening and survival of oysters. It is therefore doubtful whether *Crepidula* is a serious competitor for food to the oyster (Korringa, 1949a, 1951d). It is very interesting to note here the observation of Werner (1951) that *Crepidula* collects its food by pumping the water through two different mucous filtering systems, a process closely resembling that in bivalves. *Crepidula* may, however, become a serious oyster pest when it occupies the space meant for the young oysters. It may settle down in incredible numbers on shells scattered as oyster collectors. Instead of young oysters, one then finds in due course dense masses of the characteristic slipper chains, the permanent associations of individuals of either sex. This competition has made it impossible to continue scattering the cheap but resistant *Cardium* shells as oyster collectors, and has thus forced the oystermen to revert to more expensive systems of collecting oyster spat, such as the use of lime-coated tiles and the scattering of brittle mussel shells, a byproduct of the mussel canneries, on which *Crepidula* has little chance to build up large chains. It was moreover found that old decaying shells of *Crepidula* may be just as dangerous in the spreading of shell disease as the *Cardium* shells once scattered in such enormous quantities. A third reason why *Crepidula* should be considered as an oyster pest is that it destroys great numbers of oyster larvae by ingesting them and depositing them in its sticky feces, from which they cannot free themselves.

There is therefore every reason to make an effort to control this oyster pest. I have earlier described (Korringa, 1941b, 1942) how *Crepidula* can be cleared away by dredging. Once the beds are properly free from potential collectors, *Crepidula* has little chance to regain the lost territory, so that oysters can be planted there with success. In the war years *Crepidula* was used as a raw protein material in the production of human food, which led to the dredging away of about 30,000,000 kg. of slipper limpets. Unfortunately, this could not be continued after the war, and I believe that the suggestion made by Orton (1945) of working along similar lines in England will be difficult to realize on a self-supporting basis, the more so since

the British oyster industry has no powerful dredgers at its disposal.

On grounds which have become derelict *Crepidula* has been kept under control by the planting of mussel seed, which developed well and smothered the limpets (Korringa, 1951d). Other methods had to be worked out for oyster grounds suitable for the production of oyster spat. The settlement of slipper limpets may seriously counteract the oystermen's efforts to increase the production of spat. On the basis of an American drill control experiment (Anon., 1948), in which corrosive sublimate was used with success, I worked out a method of chemical control of *Crepidula*. This method has since been adopted by the Dutch oystermen with considerable success. Wherever too many young slipper limpets have settled on oyster collectors, the latter are dredged up and brought ashore. After thorough washing, they are placed in large concrete tanks and immersed in sea water containing corrosive sublimate in a proportion 1:15,000 for 2 hours. The young oysters close their shells tightly and thus avoid injury, but the *Crepidula* do not seem to be aware of the poison and accumulate so much of it that they die. Instructions for the application of this treatment have been given in a separate paper (Korringa, 1949b). It is very fortunate that the mercury concentration used was at the same time sufficient to kill the early stages of shell disease, and so served a double purpose.

In recent years the arrival of a new competitor for space has added to the troubles of the European oyster industry. The barnacle *Elminius modestus* Darwin was accidentally transported from the Southern Hemisphere to British waters and has multiplied so enormously there that it soon became much more numerous than the native barnacles on English East Coast oyster beds (Knight Jones, 1948). Because *Elminius* settles heavily during and after oyster spatfall, it competes more keenly with the young spat than any native barnacle. The oystermen have also to go to considerable expense in scraping their barnacle-covered oysters before the latter can be marketed. We should also remember that it is highly probable that *Elminius* destroys large numbers of oyster larvae (cf. Cerruti, 1941). Efficient methods of control have not yet been developed (Cole, 1951). No practical application has yet been made of the observation of Ota (1948) that the settling of barnacles is much lighter on collectors which have been shaded by straw matting. This might be helpful in the European oyster industry.

The apparent vigor of newly introduced species like *Crepidula* and *Elminius*, which give little cause for concern in their native countries, is difficult to explain. I remarked earlier (Korringa, 1942) that the assumption of the "invigorating effects of a new environment" gives no proper explanation. Werner (1948a) has pointed out the absence of enemies of *Crepidula* in European water Perhaps this is the explanation, especially if we consider microbial parasites like those which have been found to destroy so many oysters. It is certainly possible that the few invaders which established the new populations failed to bring along their own, so far unknown, microbial parasites and diseases. It deserves serious consideration whether we should not make an effort to introduce such controlling factors by collecting *Crepidula* and *Elminius* from many places where they occur naturally, and then flying them in to our threatened oyster districts. Since both *Crepidula* and *Elminius* will do little or no harm when present only in small numbers, such a system of natural control would be so much cheaper than chemical and mechanical control, that it would certainly be interesting to try it, provided an experienced shellfish biologist were entrusted with the work, in order to reduce the risk that yet more pests might be imported.

XXVI. BIBLIOGRAPHIES

Cahn (1950) incorporated in his description of the Japanese methods of oyster culture valuable information on scientific and technical contributions published in the Japanese language, and therefore inaccessible for most of us. Cahn mentioned that he made use of translations and abstracts of these papers, which were especially prepared for this purpose. We should certainly welcome complete reproduction of these translations and abstracts. Personally I should very much like to have a translation of the book by Fujita (1943) on the diseases of fish and shellfish.

A very extensive bibliography on oyster literature is that by Baughman (1948), in which there are listed thousands of papers dealing with oyster culture and oyster biology. Abstracts are given of many of those papers, especially of those dealing with oyster cultural aspects in North America. The salient points in the papers are incorporated in the abstracts, which are especially valuable

when dealing with unpublished reports and papers published in journals with a small circulation. It is regrettable that so few copies have been printed that very few shellfish biologists, who often have to work at a considerable distance from large libraries, are in a position to consult this valuable bibliography. We therefore hope that Baughman's plans to issue a second revised and amplified edition will materialize in the near future.

Though published after conclusion of the manuscript of this review, I do not want to omit the bibliography compiled by Ranson (1952). He has listed a great number of bibliographical items on oyster biology and oyster culture, many of which cannot be found in Baughman's book, and conversely.

ACKNOWLEDGMENTS

Thanks to pleasant relations with many colleagues all over the world, I have been able to make the present review almost complete and up to date. I sincerely hope that the positive criticism I have been asked to advance in this review will not affect our friendship, but will serve to stimulate our common interest in further research so as to build a sound basis for the oyster industries all over the world.

I wish to thank Dr. C. O. van Regteren Altena of the Leyden Museum of Natural History for his advice in the nomenclatural problems.

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SUMMARY

A great many papers dealing with the biology of the oyster have been published in recent years, and such a variety of topics is dealt with that it could support the paradoxical verdict, "specialization precludes a one-sided view." Though considerable advances have been made in recent years, there are so many gaps in our knowledge, besides a variety of old and new controversies and discrepancies, that we can make many programs for further research.

The salient impression made by the recent advances in oyster biology is that there is considerable doubt about the value of several opinions once generally accepted.

The question of the oyster's taxonomy is at last being cleared up, and there is every reason to anticipate the publication of a rather revolutionary revision of oyster systematics. Of great theoretical and practical importance is a clear distinction between the three types of oysters, *Ostrea*, *Gryphaea*, and *Pycnodonta*.

Since the application of histochemical methods much more is understood about the changes in the oyster's chemical composition. Feeding appears to be a much more delicate and complex process, influenced by a greater variety of factors, than earlier oyster biologists realized. Living diatoms most probably do not constitute the oyster's main diet. Other items may not only be more abundant, but also more readily digestible. It has been demonstrated that the oyster is in a position to collect very small food particles, and from this we may conclude tentatively that the importance of very small particules of organic matter has so far been greatly undervalued in invertebrate biology. It is not yet clear whether truly dissolved organic matter can be utilized directly as food by the oyster, but there are indications that such products can both stimulate and inhibit its intricate feeding mechanism.

Since a quantitative understanding of many food chains and of the potential productivity of inshore waters is still very fragmentary, it has not yet been possible to give a satisfactory explanation for the fact that oysters thrive especially under certain estuarine conditions, and not under others. The old view that it is especially the factors of water-temperature and salinity—so easy to measure—which render these waters so attractive for oysters, is certainly most incomplete. Oysters, especially those of the *Gryphaea* type, are adapted to a wide range of salinity, but appear to make rather high demands on the food content of the water for their normal growth and fattening. In the larval development of the oyster, too, factors other than water temperature and salinity have so far been greatly underrated. Absence of adequate quantities of suitable food is probably often a limiting factor in larval development. Currents have certainly a great influence on the distribution and the setting of oyster larvae. An entirely new aspect is the gregarious tendency in the setting of oysters and other invertebrates. A *quantitative* understanding of larval development and setting has made it clearer why seriously overfished natural oyster beds often show no revival.

A serious gap in our knowledge is the complete absence of information on hereditary qualities in the oyster. Breeding from well-selected strains of oysters has become a possibility through the development of a system of tank breeding. The

development of knowledge regarding the genetical constitution of the oyster may in due course greatly benefit the oyster industry.

Our knowledge of diseases and high mortalities in oysters and other shellfish has advanced rapidly, through the discovery of some dangerous microbial parasites. Similar parasites will no doubt be found responsible for many "normal" and "abnormal" oyster mortalities, and may also complicate the picture when there is serious competition from organisms which do not easily kill the oysters directly.

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NARIAL BREATHING IN FISHES AND THE EVOLUTION OF INTERNAL NARES

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INTRODUCTION

ONE structure which has been most intimately connected with vertebrate life on land is the internal naris. All terrestrial vertebrates possess nostrils opening into the mouth, while all but a very few of the primarily aquatic forms, that is, the fishes, lack them. Nevertheless, the origin of internal nares has never been adequately explained, nor has their utility to the aquatic ancestors of the first backboned inhabitants of the land been demonstrated convincingly. It was thought therefore that a review of the use to which these structures are put by the few living fishes possessing them might shed some light on their evolution.

A passageway, leading from the exterior past the organ of olfaction into the mouth or pharynx, exists in widely divergent fish-like vertebrates (Fig. 1). These include species of the most primitive types extant as well as the most advanced. The problem of the homology of the similar structures involved has not yet been settled completely. Present-day evidence points to the following conclu-

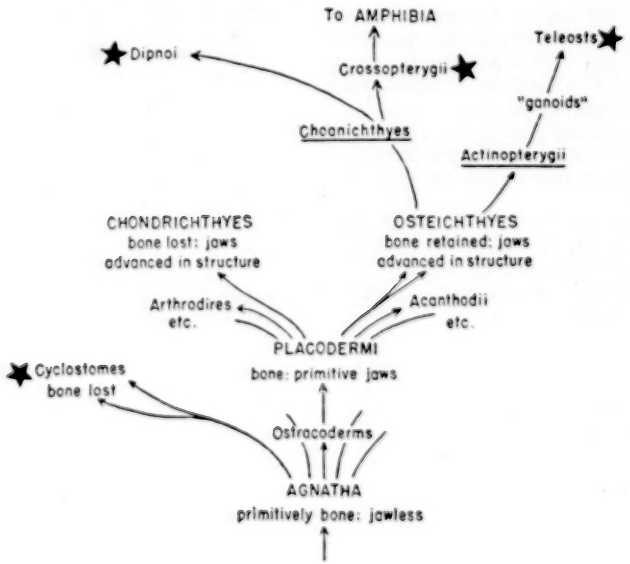

FIG. 1. THE PHYLOGENY OF FISHES
Those groups containing species with internal nares are starred. Diagram from Romer (1946)

sions, however, (1) that the single internal naris of the hagfishes stands phylogenetically off by itself, (2) that the internal nares of the crossopterygians and lungfishes are not homologous with those of teleosts, but (3) that their internal nares are homologous with those of the amphibia and all other terrestrial vertebrates.

NARIAL BREATHING IN LIVING FISHES

Cyclostomi

In the hagfishes, in contrast to the lampreys, the single median nostril communicates with the pharynx. Two different views of the utility of this arrangement have been advanced. According to Young (1950), "When it feeds, this animal buries the head in its prey, and the only opportunity for intake and output of water is then through the branchial openings, which lie far back for this purpose. Probably the communication between the nose and the pharynx enables the hag-fish to 'smell' even when its head is embedded in the prey." Parker, Haswell, and Forster-Cooper (1949), on the other hand, imply that this opening facilitates breathing when the hagfish burrows, and state that "*Myxine* commonly lives nearly buried in mud, and the respiratory current passes through this passage to the gills." It is also entirely possible that the faculty of drawing water through the olfactory chamber along with the rhythmical respiratory current enables these blind creatures to locate their prey more effectively.

Choanichthyes

Crossopterygians. Although the crossopterygians are generally characterized by the presence of internal nares, these organs are believed to have been secondarily lost by one branch of the group, the coelacanths (Stensiö, 1921; Watson, 1926; Moy-Thomas, 1939; Jarvik, 1942). The only living crossopterygian—the coelacanth *Latimeria chalumnae*—does not exhibit nostrils opening into its mouth (J. L. B. Smith, 1939).

Lungfishes. The lungfishes (Dipnoi), now thought to be specialized descendants of the crossopterygian stock or to be derived from a common ancestral form (Westoll, 1943, 1949; Romer, 1946), are also generally believed to possess internal nares.

The peculiar position of their exterior nares—on the underside of the upper "lip" (Fig. 2)—has made the interpretation of them a matter of controversy. It was suggested at one time that both pairs of nostrils actually lie within the oral cavity. Huxley (1876a, b) showed that this is not so, and that in both the Australian and one of the African lungfishes the anterior pair of nares is definitely located outside of the mouth. This can readily be seen when any of the five living species of lungfishes are examined with the jaws closed. Other workers, most notably Jarvik (1942), have believed that "the incurrent and excurrent nostrils in Dipnoans are anterior and posterior external nostrils respectively which have migrated down to the roof of the mouth cavity." In other words, they represent a structure similar or homologous to the paired nasal sacs, each with its two external nares, of most of the Teleostomi. This view has been opposed by Romer (1946), principally on the ground that the jaws of lungfish have become greatly foreshortened. Westoll (1949) also disagreed with Jarvik's interpretation. Unfortunately, the embryological development of the nares in lungfish (Kerr, 1932; Fullarton, 1934) throws no light on this question.

In considering the functions of the nares of lungfishes, a clear conception of all of the possibilities involved should first be obtained. Failure to do so was undoubtedly one of the reasons for the gratuitous assumptions concerning them which have been made by a number of workers. The following outline summarizes the various possible functions in which the nares of lungfishes may be involved:

I. In smelling
II. In breathing
  1. In aquatic breathing
  2. In aerial breathing
    a. While aestivating
    b. While not aestivating

Data covering all of these categories are still not available for all five species of recent lungfishes.

African lungfishes. Because of the more or less concealed position of the exterior nares in lungfishes, it is difficult to determine how they are used. Observations were made on four *Protopterus annectens* and *P. aethiopicus* in the collection of the New York Aquarium. Most successful were those made on a 3-foot *P. aethiopicus*, living in clear water which nevertheless contained an abundance of small particles of detritus of the type that frequently accummulates at the bottom of standing aquaria. With the aid of a flashlight the gentle flow of particles entering the mouth and nose could be seen. It was observed (1) that no water at all may be taken into the oral cavity for considerable periods of time, (2) that water may be drawn in through the nostrils, the jaws being

completely closed, (3) that with the jaws barely open, a small amount of water may be drawn in through both nose and mouth or through mouth alone, and (4) that copious quantities of water may be taken in through the more widely opened mouth—at which time it could not be determined whether any water was passing through the nares or not. When denied access to the surface, a specimen greatly raised its irregular rate of branchial respiration, taking in all, or nearly all, of the increased supply of water through its mouth. At no time did the nose of *Protopterus* appear to play an important part in aquatic respiration; none of the four specimens observed could be considered a narial breather.

On the other hand, what narial breathing *was* exhibited by these lungfish did not seem to be invariably associated with exploratory olfaction, since it sometimes occurred while the fish rested quietly. It is quite possible, of course, that they *were* sampling the environment at such times. Dropping some finely macerated horse heart (one of their regular foods) into the water in front of them sometimes induced these specimens to move about, as if in search of food, but never caused them actually to "sniff," as described by Kerr (1910, 1932). There is, however, no doubt that the nose functions in a sensory capacity in *Protopterus*, and our general observations, like those of Bateson (1890), indicate smell to be more important than sight, at least in the location of food.

FIG. 2. AFRICAN LUNGFISH, PROTOPTERUS AETHIOPICUS, TAKING A GULP OF AIR IN AN AQUARIUM

The external (anterior) nares are clearly visible at the juncture of the light-colored mouth and the dark-colored snout. The openings of the internal (posterior) nares are above and in front of the prominent crescent-shaped ridge on the roof of the mouth. The mouth is not always opened so widely during aerial breathing. Photograph by S. C. Dunton, New York Zoological Society.

The part played by the nose of the African lungfish in aerial breathing can be more definitely ascertained. It should be noted in this connection

that these fishes die of asphyxiation, if prevented from coming to the surface to obtain atmospheric air, even in well aerated water (H. W. Smith, 1931). Periodically air is taken directly into the open mouth, which is pushed above the surface of the water (Figs. 2 and 3). This behavior was described by Gray (1856).

M'Donnell (1860) believed that *Protopterus* breathed through its nose during aestivation, but the structure of the fish's cocoon precludes this and makes oral breathing a necessity. H. W. Smith (1930), G. M. Smith and Coates (1937) and Poll (1938) have described this covering of dried mucus and agree that it is continuous over the whole body, save in the region of the mouth. Here the cocoon dips into the oral cavity, as a tube perhaps half an inch long and open at the end (Fig. 4). It thus bypasses the exterior nares completely, and narial breathing is therefore an impossibility. H. W. Smith (personal communication) noted particularly that the tube extends well into the mouth and that it is entirely solid where it covers the nostrils. He saw no possibility of the fish's breathing air through these organs during aestivation. Despite the fact that Parker's (1892) Fig. 67 (Fig. 4 of the present paper) clearly shows otherwise, Parker seems to have believed that the oral tube of the cocoon leads to the anterior nares. Dubois (1892) observed the breathing of an aestivating *Protopterus annectens* and described how air is passed in and out through the open mouth.

Most observations and experiments on African lungfish have been made on *Protopterus annectens*, some on *P. aethiopicus*, and few, if any, on *P. dolloi*. Nevertheless, because of the close structural and behavioral similarity among all three species, the carrying over of findngs from one to another seems justified—in the absence of any evidence to the contrary. This assumption would permit the generalization that among all the African lungfishes the nose is never used in aerial breathing and is only intermittently employed to take in water.

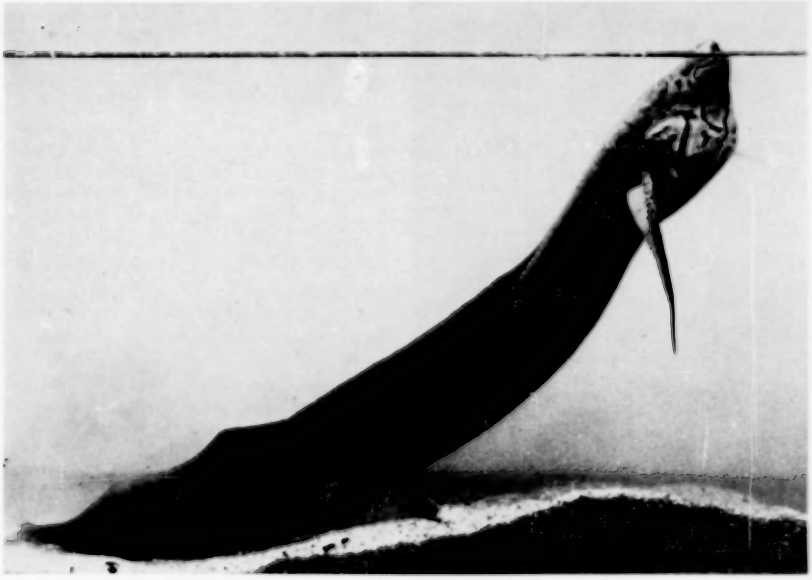

FIG. 3. AFRICAN LUNGFISH, PROTOPTERUS ANNECTENS, JUST COMPLETING THE ACT OF TAKING A GULP OF AIR IN AN AQUARIUM

The gular region is inflated with air. Photograph by S. C. Dunton, New York Zoological Society

South American lungfish. Like its African relatives, the South American lungfish, *Lepidosiren paradoxa*, is asphyxiated if kept under water (Carter & Beadle, 1931; Sawaya, 1946) and can aestivate during the dry season. It does not form a

cocoon, however (Hunt, 1898; Carter & Beadle, 1931). For this reason the question whether or not it breathes through its nostrils during aestivation must remain unanswered until more detailed accounts of its behavior at such times are available. It is definitely known that the fish when free-living does not use its nose for aerial breathing (Goeldi, 1898; Kerr, 1900), its method of taking in

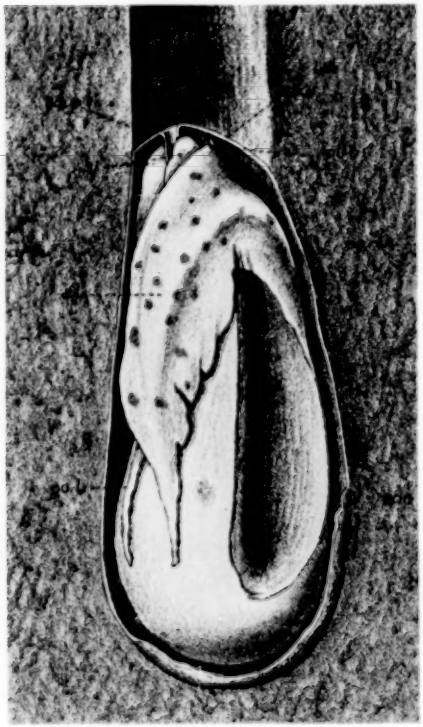

FIG. 4. PROTOPTERUS ANNECTENS
Diagram of torpid *Protopterus annectens*, in situ. The earth and wall of the capsule are removed on one side. From Parker (1892), including caption.

atmospheric air being practically identical to that of *Protopterus* (Fig. 5). The extent to which the South American lungfish employs its nose for aquatic breathing is unknown. According to Kerr (1900), smell is a more important sense than sight to this species, which he described as "apparently sniffing" when food is about.

Australian lungfish. The Australian lungfish, *Neoceratodus forsteri*, has better developed gills

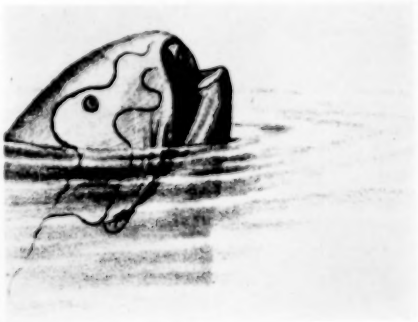

FIG. 5. LEPIDOSIREN PARADOXA DURING RESPIRATION ON THE SURFACE
From Goeldi (1898), including caption

than either the South American or African species, and may spend hours below the surface without coming up for air, all the while breathing regularly in a conventional piscine manner (Bancroft, 1918; Longman, 1928). When they are active, as at night, or the water is somewhat warm or foul, Australian lungfish come to the surface to engulf atmospheric air more frequently. According to Longman, individual variability also seems to be a factor influencing the rate of aerial breathing. In breathing, the mouth is widely opened and the snout thrust well out of the water (Dean, 1906; Longman, 1928), and narial breathing is therefore insignificant or nonexistent at such times (Fig. 6). In keeping with its more aquatic habits, *Neoceratodus* is apparently incapable of aestivating out of water.

Dean (1906) described *Neoceratodus* as a nostril-

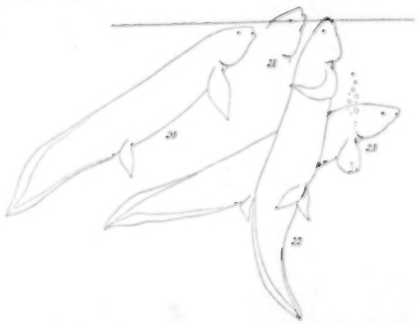

FIG. 6. FOUR SUCCESSIVE STAGES IN THE AERIAL BREATHING OF NEOCERATODUS FORSTERI
After Dean (1906)

breather durings its periods of aquatic respiration, but the eleven specimens observed by Longman (1928) usually breathed directly through the open mouth. Subsequent observations by Dean (1912) led him to believe that a more rapid rate of breathing was accompanied by a wider opening between the jaws—presumably to admit more water. Recently the writer had an opportunity to watch the respiratory behavior of two Australian lungfish, one slightly longer than 3 feet and the other somewhat more than 2 feet long, living in the John G. Shedd Aquarium, Chicago. The configuration of snout and jaws of these fish is such that when they rested upon the bottom of their glass-sided tank, it was sometimes impossible to determine whether the mouth was open or shut while the gill-covers were rhythmically passing out water. At all times when such determinations were possible, however, the mouth was seen to be slightly but definitely open. Dr. Earl S. Herald kindly made observations on the two *Neoceratodus* on exhibition at the Steinhart Aquarium, San Francisco, and his report is practically identical to our own. Thus, the two specimens studied by Dean (1906) behaved differently, so far as aquatic breathing is concerned, from the fifteen individuals that have since been observed. We conclude that either their behavior was abnormal or Dean's interpretation of what he saw is at fault, and that *Neoceratodus* does not habitually use its nose in aquatic respiration. Although there is no critical evidence bearing on the point, both structure and behavior indicate that the Australian lungfish depends more on smell than on sight to obtain its food (Longman, 1928).

Broman (1939) concluded that *Neoceratodus* and *Protopterus* probably do not breathe air through their noses because histological examination failed to reveal nasal glands of the sort that function in terrestrial forms to keep the mucous membrane moist. This interpretation appears unsatisfactory, however. It is difficult to understand why a creature that lives in water and breathes relatively infrequently would need lubricating nasal glands, even if its nose *were* used in aerial breathing.

Actinopterygii

Among the Actinopterygii (Teleostomi), internal nares are usually considered to be lacking, although their presence in one genus, *Astroscopus*, was discovered more than forty years ago. Moreover, a number of eels are known to possess posterior nares which open into the mouth. These fishes belong to, or are related to, the Echelidae and Ophichthidae. Their posterior nares are located in the upper jaw, opening either as a simple transverse or longitudinal slit, or being associated with a flap or valve (Fig. 7). In some of these eels the posterior narial openings lie entirely outside the lateral margins of the mouth; in others they are partially included in the oral cavity when the mouth is closed; and in still others they are completely enclosed within the mouth by the lower jaw. Not much is known about the mode of life of echelid or ophichthid eels, but at least eight genera have been described as burrowing in sand

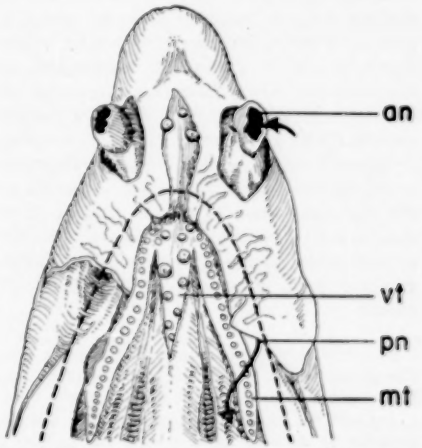

FIG. 7. VENTRAL VIEW OF HEAD OF THE OPHICHTHID EEL, MYRICHTHYS ACUMINATUS

Lower jaw and part of right nasal passageway have been removed. The dotted line indicates the extent of the lower jaw when closed, showing how it includes part of the posterior nares within the oral cavity. *an*, anterior naris; *mt*, maxillary teeth; *pn*, posterior naris; *vt*, vomerine teeth. Specimen collected at Englewood, Florida, by C. M. Breder, Jr. Drawing by Donn E. Rosen.

or mud. It is tempting to consider the inclusion of their posterior nares within the oral cavity as an adaptation to a burrowing existence—especially since the posterior nostrils frequently open externally toward the rear, and digging is characteristically performed tail first. Correlation between structure and habit is far from perfect, however; a number of the species known to bury themselves do not possess posterior nostrils concealed inside the mouth (Gosline, personal communication).

Internal nares have been described in but a single genus of acanthopterygian: the highly speci-

alized *Astroscopus* of the western Atlantic and eastern Pacific, belonging to the family of stargazers, the Uranoscopidae. This unusual condition was first briefly reported by Dahlgren (1908) and was later described and interpreted in more detail by Dahlgren (1927) and Atz (1952). Each nasal capsule of *Astroscopus* exhibits two openings to the exterior, the anterior and posterior nares typical of bony fishes. In addition, the nose is connected to the mouth by a well developed passageway. *Astroscopus* characteristically lies buried in sand, and Dahlgren presented evidence which clearly indicated that the internal nares of this fish facilitate breathing while the mouth is partially or completely covered with sand. Water drawn in through the nostrils supplements, or substitutes for, that ordinarily entering by way of the mouth. Atz suggested that this structure might also make possible more efficient olfactory sampling of the environment and that such an arrangement would therefore have survival value to a sedentary fish like *Astroscopus*. *Astroscopus guttatus*, *A. y-graecum* and *A. zephyreus* are all known to exhibit internal nares, but Atz was unable to find similar structures in any other closely or distantly related genera.

In one of a sample of five specimens of the sole, *Cynoglossus semilaevis*, Kyle (1900) discovered a single large perforation in the roof of the mouth, communicating with the accessory nasal sac. He used this observation as the basis for suggesting that perhaps a new species had been discovered which was the only teleost (then) known to have internal nares. Johnstone (1904) could find no internal nares in several specimens of five other species of soles, examined by dissection or sectioning. In some of them, parasitic copepods were found living within the nasal cavity. Johnstone believed that Kyle's specimen was merely an abnormal one, perhaps suffering from the attack of such a parasite, and therefore of no particular significance. This interpretation seems to have been tacitly accepted by everyone who has considered the matter (e.g., Chabanaud, 1927; Matthes, 1934; Berg, 1940) and even by Kyle himself (1926).

DISCUSSION

The transition from an aquatic to a terrestrial mode of life perforce requires the development of methods of water conservation, and in addition usually necessitates changes in structure and behavior concerned with locomotion, sensory perception, reproduction, and respiration. Problems involving all of these factors were met and solved by the vertebrates in their conquest of the land.

Pearse (1950) has pointed out that "there is abundant evidence from the past and present which indicates that air-breathing originated on beaches and in stagnant water long before life developed on land." The rhipidistian crossopterygians—considered by Watson (1926), Moy-Thomas (1939), Westoll (1943), Romer (1946), and others to be the aquatic ancestors of the first tetrapods, the amphibians—are supposed to have breathed air. The evidence for this is circumstantial, being based (1) on indirect anatomical indications of the presence of an air-bladder, such as markings on vertebral centra, (2) on the definite presence of either an air-bladder or a lung in the coelacanths and lungfishes, both of which are believed to be specialized derivatives of the crossopterygian or precrossopterygian stock on ample anatomical grounds, and (3) on the frequent occurrence of rhipidistian fossilized remains in freshwater deposits—in a geologic period in which such habitats were characteristically swampy and subject to periodic desiccation.

Narial breathing in fossil fishes

The assumption of the habit of breathing atmospheric air by vertebrates has almost always been associated with the development of internal nares. The earliest known terrestrial forms possessed them, and the available evidence from fossils indicates that their crossopterygian ancestors were also so equipped. It seems to have been assumed that these structures were employed to breathe air; in fact, their presence in fossil crossopterygians has been considered evidence that these fishes possessed functional lungs (Watson, 1926; Romer, 1945). Westoll (1943) declared devices such as the air-bladder and the choanal passage "essential for the successful evolution of animals able to leave the water," while Parker, Haswell, and Forster-Cooper (1949) went so far as to state that "the apparently trivial feature that made this enormous change [from aquatic to terrestrial life] possible was the acquisition of a nostril inside the mouth, whereby the lung, already in partial use, was enabled to assume a much greater role."

Why internal nares were necessary to aerial breathing or why their use had greater survival value than the taking of air directly into the mouth has nevertheless seldom been explained. A careful search has revealed only one suggestion, namely, that internal nostrils "permitted the intake of air into the lungs without the necessity of opening the mouth and running the risk of 'shipping water'" (Romer, 1945.)

We have seen that, so far as known, no living fish employs its nostrils to breathe air. The behavior of those species of recent fishes which are provided with internal nares thus lends no support to Romer's suggestion; in fact, it offers no clue at all as to the original connection between those structures and aerial breathing. Since the lungfishes, echelid and ophichthid eels, and stargazers all represent specialized terminal branches of the piscine phylogenetic tree, this is perhaps not surprising. Certainly the negative evidence which they furnish should not be assigned too much weight. Romer (personal communication) has also pointed out that the gape of fossil crossopterygians was undoubtedly much greater than that of present-day lungfishes, and that this anatomical difference may have made the shipping of water much more likely to occur in them. That modern lungfishes do not use their nostrils in aerial breathing may be associated with their very short gape, Romer believes.

Denison (1941) presented fossil evidence that the placoderm, *Bothriolepis*, had lungs, but he found no communication between the external nasal passages and the mouth. He believed that this fish "gulped air in the same manner as do present-day lung fishes." Myers (1942), however, has thrown serious doubt upon the postulated method of breathing and the supposed respiratory function of the air sacs.

When it is recalled that a considerable number of species of living fishes breathe atmospheric air and that none of them—except the lungfishes—has nostrils communicating with the mouth, the question of the utility of internal nares to air-breathing fishes becomes even more puzzling. Table 1 indicates the wide variety of fishes which are more or less dependent on atmospheric air. It does not include those families containing species that only occasionally supplement aquatic breathing with atmospheric air, e.g., the Amiidae, Lepisosteidae, Umbridae, Characidae, Loricariidae, Ophichthidae, and Gobiidae. The families and genera listed have members that are obligate air-breathers, and/or characteristically inhabit terrestrial or aquatic environments which require them regularly to take in atmospheric air. In all of the genera listed, except *Periophthalmus* and probably *Andamia*, the method of obtaining air is to break the water surface and to take the gases directly into the mouth, frequently with gulping movements.

It might also be mentioned that *Polypterus* takes in air through its spiracles (Budgett, 1903) as well as its mouth (Budgett, 1903; H. W. Smith, 1931); and we have observed that under certain circumstances bichirs rarely, if ever, breathe air. Among the Ophichthidae, *Pisodonophis*, whose posterior nares open within the oral cavity, sometimes breathes atmospheric air (Hora, 1933), which it takes in through its mouth (Day, 1877).

TABLE 1

Representative Genera of Obligate and/or Habitual Air-Breathing Fishes

Based on Carter and Beadle (1931) and on Das (1941)

Ceratodidae
- *Neoceratodus* (Australian lungfish)

Lepidosirenidae
- *Lepidosiren* (South American lungfish)
- *Protopterus* (African lungfishes)

Polypteridae
- *Polypterus* (bichirs)

Megalopidae
- *Tarpon* (tarpon)

Arapaimidae
- *Arapaima* (pirarucu)

Cobitidae (loaches)
- *Misgurnus* (weather fish)
- *Lepidocephalus*

Gymnotidae (knifefishes)
- *Hypopomus*

Electrophoridae
- *Electrophorus* (electric eel)

Clariidae (Old World tropical catfishes)
- *Clarias*
- *Saccobranchus*

Callichthyidae (armored catfishes)
- *Callichthys*
- *Corydoras*

Synbranchidae (synbranchid eels)
- *Synbranchus*
- *Monopterus*

Amphipnoidae
- *Amphipnous*

Ophicephalidae
- *Ophicephalus* (snakeheads)

Anabantidae
- *Anabas* (climbing perches)
- *Macropodus* (paradise fishes)
- *Betta* (fighting fishes)

Periophthalmidae
- *Periophthalmus* (mudspringers)

Blenniidae
- *Andamia* (rock skipper)

This is a most diverse group of fishes, both structurally and phylogenetically, and the species included live under a number of different environmental conditions. Yet all of them regularly breathe atmospheric air—in a similar manner, and without the aid of internal nares. They thus

provide no inkling of the peculiar physiological or environmental conditions that must have existed during the evolution of the crossopterygian ancestors of the amphibia, if it is assumed that internal nares and aerial breathing were indissolubly associated with each other during that phase of vertebrate evolution.

In contrast to this view, Kerr (1932), basing his view on his studies of the lungfishes, stated that the dipnoan nose was entirely a sense organ, and that "it is not until the Amphibian grade is reached that the olfactory organ becomes the respiratory channel for air-breathing." Similarly, Young (1950) has suggested that "the internal nostril may have originally developed from the double nostril of fishes, in order to make a circulation around the olfactory receptors possible." So far as the lungfishes are concerned, there seems no doubt that smell is the most important sense by which they explore their environment, and according to Huxley (1876a) and Kerr (1910, 1932) the presence of internal nares enables them more efficiently to bring water into contact with the nasal sensory membrane. Whether similar advantages accrued to the ancient crossopterygians remains a matter of speculation, of course. If the utility of internal nares in the crossopterygians was sensory, only later becoming associated with breathing, this situation could be considered a clear-cut instance of preadaptation—in the sense used by Simpson (1944), viz., "the existence of a prospective function prior to its realization" (p. 186).

The earliest tetrapods were aquatic, and apparently the only advantage they enjoyed over their crossopterygian ancestors and contemporaries was their ability to move overland in order to find a new pool or swamp when the water in which they were living dried up (Romer, 1945). The utility of internal nares would thus presumably have been the same in both groups, at least at first. Romer (personal communication) has suggested that these structures may have come to be habitually employed in breathing air because their use would help prevent the drying out of the gills. Moreover, the problem of desiccation through the aerial respiratory medium undoubtedly still remained after the loss of gills and the assumption of a more terrestrial mode of life. Among modern amphibia, for example, the peculiar mixing in the oral cavity of fresh air from the exterior with air brought up from the lungs, before inspiration occurs (Whipple, 1906; Bruner, 1914; Noble, 1931), may be best interpreted as a means of ensuring maximum gaseous interchange along with minimum loss of water (Young, 1950).

Narial breathing in the Amphibia

To find respiratory utility for internal nares among modern amphibians is not difficult. One of their most characteristic methods of breathing is buccopharyngeal respiration. It is conceivable that this could operate through a periodically opened mouth, but difficulty would exist in providing this relatively large opening with a valve that would operate efficiently under the small resistance offered by air—as compared to water, by means of which the oral valves of fishes are made to work. In this regard, it is noteworthy that special devices to keep the mouth tightly closed and to open and close the nares are found in a number of different amphibians (Noble, 1931). During pulmonary respiration following submergence, however, some amphibians come to the surface and breathe through the nostrils, e.g., *Cryptobranchus*, *Megalobatrachus*, and *Amphiuma*, whereas others breathe through the mouth, e.g., *Diemictylus*, *Siren*, and *Necturus* (Whipple, 1906; Bruner, 1914; Willey, 1920; Baker, 1949).

The exact functional relationship of modern amphibians to early fossil forms, so far as respiration is concerned, is problematical. Many of them, such as the anurans and lungless salamanders, are obviously highly specialized, but even the relatively primitive, water-inhabiting urodeles can only be considered as secondarily aquatic, having been derived from more or less terrestrial forms (Watson, 1926). Noble (1931) has indicated that the reduction or loss of ribs in modern species may have influenced their methods of breathing, in contrast to those employed by the early amphibians, many of which had well developed ribs (Watson, 1926; Rockwell, Evans and Pheasant, 1938; Romer, 1947). The possession of ribs does not necessarily mean that these forms practiced costal breathing, of course, and one indication that amphibians have not changed their methods of respiration much through the ages is the similarity in respiratory movements between fish and present-day amphibians, especially their aquatic larvae—a resemblance to which Watson (1926), Noble (1931), and Young (1950) have all called attention. Marcus (1923) considered the aerial breathing mechanism of the caecilians to be intermediate between that of a fish like *Protopterus* and that of the reptiles.

On the other hand, Pike (1924) noted the simi-

larities but emphasized the differences between breathing in fish and amphibian. It is also quite possible that the pulmonary respiration so characteristic of present-day amphibians—in which air is forced into the lungs by means of the buccopharyngeal "pump"—represents a specialization confined to that group, rather than a step in the transition from the wholly aquatic breathing of fish-like vertebrates to the aerial breathing of reptiles, mammals, and birds (L. Willem, 1924; V. Willem, 1931).

Much remains to be discovered about the respiration of recent lungfishes and amphibians, especially the neural mechanisms involved, the study of which might well throw new light on the origin of air-breathing in vertebrates.

Origin of internal nares in tetrapods

From the above data, a theory accounting for the presence of internal nares in the tetrapods may be formulated as follows. Internal nares first served as adjuncts to the organs of smell in aquatic vertebrates, making possible an arrangement of greater efficiency, and therefore of greater survival value, than that exhibited by ancestral fishes whose nose lacked communication with the mouth. Internal nares were thus preadapted for use in aerial breathing. In the amphibians and their immediate crossopterygian ancestors, these organs probably aided in preventing desiccation, both of the gills and lungs. The buccopharyngeal method of aerial respiration was probably taken up by the Amphibia very early in their existence, or perhaps even during the crossopterygian-amphibian transition, and in this process internal nares provided for the most efficient ventilation.

This scheme, explaining in part the origin of air-breathing vertebrates, is neo-Darwinian in approach, avoiding the Lamarckianism of Kyle (1900) and Das (1941) and the orthogenetic overtones of Watson (1926). It is in harmony with the ideas of Carter (1951), who believes that preadaptations existed at each stage in the evolution of vertebrates from water to land. Carter has pointed out that blood which was insensitive to carbon dioxide was essential to a fish invading stagnant, tropical waters and that this type of circulatory fluid was preadapted to the evolution of a lung, because of the considerable concentration of carbon dioxide inside such an internal, air-breathing organ. The lung was a valuable asset to a fish living under those environmental conditions and was, in turn, preadapted to breathing on land.

The presence of internal nares in *Astroscopus* has little bearing on the problem of the origin of these structures in the ancestors of the tetrapods. The structures are, of course, not homologous. Moreover, no ancient crossopterygian, so far as known, was bottom-inhabiting (Romer, pers. commun.; Bobb Schaeffer, pers. commun.); their internal nares thus could not have arisen in response to selection pressures similar to those that evidently operated upon some of the stargazers (Atz, 1952). Similar conclusions might be drawn regarding the origin of internal nares among the echelid and ophichthid eels.

The widespread occurrence among fishes of accessory nasal sacs and of other devices such as ciliated cells, water-deflecting nostrils, and the median nasal sac of lampreys—all of which serve to raise the efficiency of chemoreceptive sampling of the environment by increasing the flow of water past the sensory elements—indicates that olfaction generally plays an important role in piscine life, including that of teleosts, the statements of Bateson (1890) and others notwithstanding. According to the views presented above on the origin of internal nares in the crossopterygians, these structures perform essentially the same function in fishes as do nasal sacs, nostrils with water-deflecting devices, etc.

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SUMMARY

1. None of the living fishes which possess internal nares (*Neoceratodus*, *Lepidosiren*, *Protopterus*, *Astroscopus*, and certain echelid and ophichthid eels) is known to employ these organs to breathe atmospheric air. Moreover, numerous fishes which lack internal nares regularly come to the surface to engulf air.

2. No convincing reason for the association of internal nares and aerial breathing in the crossopterygian ancestors of the amphibians has ever been advanced.

3. The view of Kerr, namely, that it was not until the advent of the amphibians that the nose was used in aerial breathing, is modified and enlarged upon. The internal naris is considered a device which first served to increase the effectiveness of olfaction by making possible a more efficient sampling of the environment. Its first respiratory utility was probably to help prevent the desiccation of gills and lungs.

4. The internal naris of the crossopterygians was thus preadapted for use in aerial respiration.

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NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will occasionally appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to H. B. Glass, Associate Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland, U. S. A.*

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GENERAL BIOLOGY: PHILOSOPHY AND EDUCATION

SCIENCE. *Its Method and Its Philosophy.* *By G. Burniston Brown. W. W. Norton & Co., New York.* $3.50. 189 pp. + 8 pl. 1950.

In this book G. B. Brown, a reader in physics at the University of London, has made a serious effort to discover and systematize those features of science that characterize it as a special way of learning.

Learning (Chapter I), in the sense of behavior modifications following experience of repeated situations, is exhibited by most members of the animal kingdom. But the use of symbols to capitalize upon experience is chiefly a human attribute.

The use of words (Chapter II) is as tricky as it is useful, and Brown offers purported clarifications of several words appropriate to discussions of science, e.g., "knowledge," "proposition," "meaning," "verification," "fact," "hypothesis," and "true." But his account of these matters gives little consideration to recent logical studies whose results might have provided it with some defensible content.

Chapter III sketches Aristotle's contributions to the methodology of the sciences, listed by the author as the invention of logic and the outline of an axiomatic method for obtaining reliable knowledge. Aristotle is criticized for his non-realization of the importance of experimental observations deliberately undertaken to test hypotheses.

The methodological views of Francis Bacon are the subject of Chapter IV. Bacon is commended for his attention to the role of experiment in scientific inquiry; but his appreciation of the value of *hypotheses* is reported to have been less than adequate. In this chapter, Brown seems to mean by "hypothesis" something like a statement containing terms that denote theoretical constructs.

A chapter on Newton is full of biographical detail, but Brown's evaluation of Newton's methodological views seems hampered by the confusions crystallized in Chapter II.

Chapter VI, entitled Modern Science, reviews the methodological work of Whewell and of Mill (especially Mill's canons of induction). It attempts to illustrate the methods of contemporary science by an analysis of William Charles Wells' *Essay on Dew* (1814). This account of Wells' experiments is easily the most interesting part of the book.

The reviewer was unable to grasp the import of Chapter VII, an account of the significance of the work of Eddington and of Milne.

The book closes with a dialogue (in the manner of Galileo), in which among other things are unrewarding

discussions of verification, truth, explanation, definition, the Achilles-and-the-tortoise paradox, the existence of other people, reality, and the semantic antinomies. This chapter is easily the worst part of the book.

This book is hard to evaluate. It is written by an obviously intelligent and competent scientist; its aims are easy to sympathize with; and it is often instructive and entertaining. But, in the reviewer's opinion, as a *methodological* appraisal of the sciences it does not come up to current standards of methodological analysis.

JOHN R. GREGG

THE ELEMENTS OF RESEARCH. *Third Edition. Prentice-Hall Education Series.*

By Frederick Lamson Whitney. Prentice-Hall, New York. $5.00. xviii + 539 pp. 1950.

This book is designed for the beginner rather than the experienced investigator and is intended for use in graduate departments as a guide for a reflective attitude in the design and solution of research projects. For a textbook of this type it is surprisingly well written and organized and can be highly recommended for anyone in a classroom, office, or research department who wishes to study his problems objectively.

DAVID B. TYLER

ANALYTICAL BIOLOGY.

By G. Sommerhoff. Oxford University Press, New York and London. $3.50. viii + 208 pp. 1950.

Biologists who are able to distinguish analysis from metaphor will recognize this volume as one of the few existing genuine contributions to general theoretical biology. The comments which follow can only hint at its content.

In Chapter I, Sommerhoff opens his analysis by stating that his aim is to characterize, in precise physical terms, the apparent purposiveness of biological systems. Some examples of purposive behavior are mentioned, and an attempt is made to divorce the kind of analysis he proposes from that which is thus far available in biological literature.

In Chapter II, the author develops stepwise the central concept of his book: the concept of *directive correlation*. He finds that in the notion of an effective response of a biological system to a changed environmental situation, four elements are tacitly or explicitly assumed: (1) the antecedent environmental circumstances evoking the response; (2) the response itself; (3) the environmental circumstances concomitant to the response; and (4) the occurrence of some event or state of affairs which may be called the focal condition (goal) of the response. When there is a set of antecedent environmental circumstances to which effective responses (with respect to a given focal condition) are possible, and when the set of attendant environmental circumstances in which these responses can occur is correlated with the set of such responses in a one-to-one fashion, then the responses are said to be *directively correlated* (relative to the given focal condition) to the attendant environmental circumstances.

In Chapter III, a mathematical definition of directive correlation is arrived at. The biological object, together with its environment, is assumed to be a physical system whose initial state is specified when the values of certain independent state—parameters are given. These parameters are taken as the arguments of functions in terms of which a causal representation of the system may be given—that is, if the initial state of the system is specified, then equations may be found and evaluated which express the later states of the system as mathematical functions of the initial state and time. By imposing suitable restrictions upon these functions and their partial derivatives, necessary and sufficient conditions are specified for saying that the state-parameters are directively correlated.

Chapter IV contains some highly suggestive preliminary applications of the author's analysis to various types of biological problems, e.g., natural selection, ontogenetic adaptation, homeostasis, morphogenesis, instinctive behavior, and learning. One wishes that Sommerhoff had done more here to explicate in full detail at least one biological concept, with the aim of showing how his analysis may be of service in clearing up really crucial ambiguities. Perhaps, however, this is a job for specialists.

There is an anticlimactic last chapter which winds up with a discussion whether statements about the existence of God have factual content. An appendix discusses certain relations between the basic assumptions of quantum mechanics and those of the concept of directive correlation.

This book is the product of a powerful, learned, and skilful mind.

JOHN R. GREGG

THE IMPACT OF SCIENCE ON SOCIETY. *Machette Foundation Lectures, Number III.*

By Bertrand Russell. Columbia University Press, New York. $2.00. x + 64 pp. 1951.

Few lectures can be more entertaining and at once more penetrating and thought-provoking than these pithy remarks on Science and Tradition, on the Effects of Scientific Technique, and on Science and Values delivered by Bertrand Russell at Columbia University in 1950. The first lecture contrasted the scientific outlook of the 17th Century with that of the 20th, in their respective attitudes toward observation versus authority, the autonomy of the physical world, the de-

thronement of "purpose," and man's place in the universe. Indeed, as respects the last of these, "did *Pithecanthropus erectus* have moral responsibility? Was *Homo pekingensis* damned? Did Piltdown man go to heaven?" or, to impale democracy rather than religion on the horns of a dilemma, "should *Pithecanthropus*, if still alive, enjoy the 'Rights of Man'? Would *Homo pekingensis* have been the equal of Newton if he could have gone to Cambridge? Was the Piltdown man just as intelligent as the present inhabitants of that Sussex village?"

The second lecture considered the "most obvious and inescapable effect of scientific technique . . . that it makes society more organic," and thus has brought into existence new positions of power and new limits to individual freedom. This leads logically to a reconsideration of the relation of science to philosophy. Bertrand Russell sharply contrasts the pragmatism of John Dewey and lesser exponents with his own creed of human happiness. True, science has given modern man longer life, a diminution of crime, and an immense increase of education and of opportunity; but in a world of precarious peace and threatened human freedoms, who would say that the boons of science are enough to make humanity happy? "The root of the matter . . . is the need for love, Christian love, or compassion. If you feel this, you have a motive for existence, a guide in action, a reason for courage, an imperative necessity for intellectual honesty . . . . all that anybody should need in the way of religion." Courageous words, for what more likely to produce a smile of derision from an assembled audience of scientific and educated persons in our time? Before the reader joins the company of cynics, let him at least read the full argument. Let him place this little book beside the equally brilliant lectures of Carl Becker on *Progress and Power*, and then make his choice. At least he will have seen the place of science in the life of man sharply illuminated. He may even be tempted to join the rare company of "Natural Philosophers."

BENTLEY GLASS

A CRITIQUE OF LOGICAL POSITIVISM.
By C. E. M. Joad. University of Chicago Press, Chicago. $2.75. 154 pp. 1950.

In this book Joad attacks certain doctrines of the logical positivists, or, to be more exact, certain ethical and epistemological views expressed by A. J. Ayer in the 1936 edition of his book *Language, Truth and Logic*. Joad's reason for doing this is that those views, which have been influential in England and elsewhere, are felt by him to create an intellectual climate in which fascism flourishes. Granting his genuine concern, and also some excesses on the part of the twenty-three year old Mr. Ayer, it is nevertheless difficult to believe that these basic fears are warranted, and it is certainly clear that Joad's critical standards are not up to those of the intellectual undertaking he deplores.

JOHN R. GREGG

THE FUNCTION OF THE UNIVERSITY. *Hazen Lectures. By The Reverend R. S. K. Seeley. Geoffrey Cumberlege, Oxford University Press, London, Toronto, and New York.* $1.50. x + 179 pp. 1948.

A timely treatise devoted to the thesis that the function of the University is to provide an antidote to fear. Unfortunately, it will probably be read only by those very few individuals who still have a sense of perspective, integrity, impartiality, and the necessary moral courage still to speak up against the mass hysteria that is rampant today.

DAVID B. TYLER

THE COLLECTED PAPERS OF ADOLF MEYER. *Vol. III: Medical Teaching.*
General Editor: Eunice E. Winters; introduction by Franklin G. Ebaugh. Johns Hopkins Press, Baltimore. Four volume set: $30.00. Vol. III: xvi + 577 pp. + 1 pl. 1951.

The third volume of Adolf Meyer's collected papers deals with his contributions to medical education. There is an introduction by Franklin E. Ebaugh, one of his pupils for long years, and now Director of the Colorado Psychiatric Hospital. He stresses Meyer's important contribution toward medical education, namely, the introduction into the medical curriculum at the Johns Hopkins Medical School of psychobiology —the study of the normal individual, and the variations in this procedure to fit the more pathological material of actual medical training.

The book is divided into 4 principal parts. The first is a reprint of Meyer's article, "The 'Complaint' As The Center of Genetic-Dynamic and Nosological Teaching in Psychiatry." This most important paper is a magnificent statement of Meyer's attitude toward psychiatric teaching, and embodies his essential philosophy. There follows a series of articles grouped together under the general heading (for the purposes of this book) of The Principles of Teaching, followed by a section on The Teaching Materials, and finally another section on The Meaning and Scope of Psychiatry. In these 3 sections are contributions describing the attitude toward the study of the normal and abnormal, including extensive material on the history of the subject, together with specific contributions toward the organization of the teaching material and the teaching processes, capped then by some philosophical considerations concerning psychobiologic and psychiatric attitudes. The book

embodies the materials which went into the making of the psychiatric curriculum of the Johns Hopkins Hospital from the beginning of Phipps Psychiatric Clinic until Meyer's retirement in 1941. The stress throughout was on objectively demonstrable facts, with a keen interest in historical perspective for the material. The purpose was to arouse interest in all current and new developments but to look always to the long-term historical evaluation of the final say and to subject all methods as much as possible to objectification.

The book closes with a series of obituary notices of important figures in neurologic and psychiatric fields, and A Revaluation of Benjamin Rush. There are a number of charts and tables to illustrate The Teaching Materials, for instance, a chart of reaction types, integration chart, segmental-suprasegmental organization, and so on. As with the other volumes, the editorial job has been beautifully accomplished, including an exhaustive index. Ebaugh's Introduction is most timely, and it is proper that the introduction should come from a pupil of Meyer and from one who himself has contributed so much to progressive modern psychiatric education. This Introduction epitomizes the spirit of the whole book. For anyone interested in a non-dogmatic type of psychiatric book, not overweighted on the side of the subjective undemonstrable aspects, this will prove an extremely timely publication.

WENDELL MUNCIE

MAN AND THIS MYSTERIOUS UNIVERSE.

By Brynjolf Bjorset. Philosophical Library, New York. $3.75. viii + 174 pp. 1949.

The dust jacket reads: "Here is 'Human Destiny,' 'The Reach of the Mind' and 'Man, the Unknown' blended into one surging symphony". I guess I must be tone deaf.

DAVID B. TYLER

TUATARA. *Journal of the Biological Society, Victoria University College, Wellington, N. Z. Vol. I, No. 1, May 1948.*

Editor: W. H. Dawbin, Zoology Department, V.U.C. Publisher: Dr. J. T. Salmon, Box 1580, Wellington, N. Z. Three issues per year. Annual subscription, 5s.; 2s. per copy.

The aim of this journal is "to bridge the gap between the usually inadequate writings on popular biology and the highly technical text-book" and "to provide articles on biological research in New Zealand readily accessible to the student and the general public." Each number, of about 45 pages, contains 5 or 6 articles. Vol. III, No. 1, for example, offers the following: The Fossil Flora of New Zealand (W. R. B. Oliver); The Biology and Control of Beetles Attacking Seasoned Timber (D. Spiller); The Classification of New Zealand Hepaticae (Mrs. E. A. Hodgson); A Guide to the Holothurians of New Zealand (W. H. Dawbin); and A Key to the Sea Urchins of New Zealand, Additional Species (H. B. Fell). The array of articles will certainly interest the professional biologist and amateurs interested in particular groups of plants and animals, in zoogeography or phytogeography, and in evolution. It must be said, however, that the level of public appreciation of the biological sciences must be considerably higher in New Zealand than in the United States, if these articles provide a valid criterion.

The paper used is suitable only for line drawings. The few halftones, such as that of the New Zealand Peripatus (*Peripatoides*), have not come out very well. Author and subject indexes are provided at the end of each volume.

BIOLOGY: HISTORY AND BIOGRAPHY

DIE ENTWICKLUNG DER ORNITHOLOGIE *von Aristoteles bis zur Gegenwart.*

By Erwin Stresemann. F. W. Peters, Berlin. DM. 32.00. xvi + 431 pp. + 15 pl. 1951.

Much has been written in recent years on the dangers of extreme specialization in science. The lack of knowledge of adjacent fields is usually stressed in such complaints, but ignorance of the past history of the field itself could be mentioned with equal justification. There is much in current research that has little significance unless considered on the background of past developments. Evidently, we are in great need of competent histories of the various branches of science.

Such a history should present either a historical development of the chief ideas of the field or give intimate biographies of those who have been responsible for the more notable advances. Stresemann has endeavored to combine these two approaches and has succeeded admirably. The development of concepts in ornithology is treated throughout on the cultural and scientific background of each period, and the reader is made aware of the respective roles of ornithology as a giver and as a taker.

No other contemporary of ours could have achieved this goal even nearly as well as Stresemann, who not only has a universal comprehension of ornithological science but has an equal interest in matters of history. This interest extends far beyond the narrower confines of his specialty, and has enabled Stresemann to treat the development of ornithology as a part of a broad intellectual and cultural stream.

History of science may be a tedious subject if undue stress is placed on an accumulation of dates and biographical detail. This volume is free of such a fault. Much technical detail is relegated to an appendix, and

history is presented as an exciting struggle of personalities and concepts.

The volume has twenty-one chapters which are grouped into three parts: the first deals with ancient and medieval ornithology; the second with the development of systematics and evolutionary studies from pre-Linnaean days to the present; and the third with the history of the living bird. It is particularly in the second part that Stresemann develops a brilliant story of trends and personalities. The battle between Linnaeus and Buffon, the history of the great voyages, Temminck and the systematic exploration of the Dutch East Indies, C. L. Bonaparte, the uphill struggle and final victory of the theory of evolution, are some of the episodes and personalities of this section. Stresemann has everywhere gone back to the original sources and acquaints us here with much unpublished material, particularly letters. A peculiar charm is given to his account by frequent quotations from the original texts. They show again and again how certain "modern" ideas have been expressed either vaguely or with amazing precision decades, or even centuries, before they were rediscovered and finally accepted. We must be particularly grateful to Stresemann for having rescued from undeserved oblivion the memory of many excellent naturalists. On the other hand, he does not hesitate to expose the weaknesses of some of the great celebrities of the past.

The volume is fascinating reading from cover to cover. Stresemann shows here once more how even the German language can be written simply and beautifully if handled by a master of prose. Ornithology has so often been pioneering new biological concepts that its history is of vital importance not only to ornithologists but to all naturalists. Everyone will find the volume stimulating reading, and will wish that an English edition were available to make it accessible to an even greater circle of readers.

ERNEST MAYR

THE DEVELOPMENT OF FUNDAMENTAL CONCEPTS IN THE SCIENCE OF GENETICS. *Portugaliae Acta Biologica, R. B. Goldschmidt. vol., Ser. A, 1949.*

By Ernest B. Babcock. American Genetic Association, Washington, D. C. 60 cents (paper). 51 pp. 1950.

A brief but valuable sketch of the development of the science of genetics to about 1934, with a list of 105 references.

CHAMBERS'S DICTIONARY OF SCIENTISTS.

By A. V. Howard. E. P. Dutton and Company, New York. $5.00. vi + 499 pp. + 1 pl.; text ill. 1951.

Science has no boundaries, either temporal or geographical. Its birth had no single witness; its growth has been continuous, although periods of lushness and dormancy have occurred irregularly; its harvests, in the form of material welfare and social and philosophical change, have been rich and varied but not necessarily wisely utilized; full fruition remains, at the present time, a utopian hope. Today, more than at any other time, our lives are governed by what is happening scientifically, and proper perspective is needed for rational judgment. History will provide the basis for such judgment, and history is largely made up of the thoughts and actions of men. A. V. Howard's book will not provide, nor does it pretend to provide, a history of science. Rather, it is biographical, each scientist of note being briefly mentioned as to birth and death dates (if deceased), education, positions held, and scientific contributions. The arrangement is alphabetical, although the index of subject matter will enable one to trace the development of any particular subject. As a reference book to the men who have made science, the volume is therefore very useful, providing as it does information on the landmarks of discovery and the heroes of science. Much weight has been given to the physical and medical sciences, with proportionally less to the biological sciences; and the names of many present-day biologists are missing from the roster.

C. P. SWANSON

BRITISH SCIENTISTS.

By E. J. Holmyard. The Philosophical Library, New York. $2.75. viii + 86 pp.; ill. 1951.

Harvey, Newton, Davy, Faraday, Darwin—these venerable names, together with many others of His Majesty's subjects, are associated with scientific theories and discoveries which have markedly altered the health, philosophy, religion, and material welfare not only of Britain but of the whole world. As a matter of national pride, it is well now and then to recall to the man in the street the heritage which he enjoys, and of which he is a part. This slender volume has this reason for being. In its less than 100 pages the reader will find concise biographies of Britain's great scientists, together with a brief discussion of their scientific contributions, and of the societies in which these men associated for the furtherance of knowledge.

SIR THOMAS BROWNE. *A Doctor's Life of Science and Faith.*

By Jeremiah S. Finch. Henry Schuman, New York. $3.50. xii + 319 pp. + 13 pl. 1950.

This is a work of critical admiration and profound devotion, of masterly absorption of the past three centuries of scholarship on Browne, and of the synthesis and understanding of Sir Thomas as a man of science,

letters, and religion. Admirers and devotees of Browne have been many; scholars and serious students, also, but fewer; and biographers of the whole man, even less. Thus, out of Dean Finch's skillful fusion comes a first-rate biography of the 17th Century physician of whom Sir William Osler wrote: "Mastery of Self, conscious devotion to duty, deep interest in human beings—these best of all lessons . . . may be gleaned from the life and from the writings of Sir Thomas Browne." One's introduction to Sir Thomas Browne is usually through his *Religio Medici*; and so most of the many critics and scholars have presented Browne as a man of belles-lettres—metaphysical poetic, religious philosopher. True, he was not without these facets; but Dean Finch shows clearly that in Browne's own eyes and in his own way of life he was first and foremost a physician and naturalist.

The strong insistence of keeping 17th century medicine and science the frame of reference for narrating Browne's biography gives this study a special and important distinction. Why Finch did not stress more of Sir Thomas's science is difficult to understand, in the light of the extremely painstaking and detailed scrutiny he has made of a tremendous volume of scholarly literature about his subject. With eminent success, the author has achieved "a warm, human portrait of one of the world's greatest scientists and explained his ideas lucidly to the non-scientific reader." Doing so, he has achieved one of the goals of the *Life of Science Library*. Even more than this, Dean Finch has succeeded in creating a clarifying and revealing biography of an outstanding man of science and letters belonging to a significant period in history. This was a period when all natural philosophers were confused and confounded by a complex and self-contradictory concept of the physical world in general and of matter in particular. Dean Finch has given us an important stepping-stone to approach with understanding both Sir Thomas Browne and his colleagues and contemporaries.

The illustrations are excellent. Detractions are on the whole minor and personal to the reviewer. The typography, printing, and binding are on the whole attractive except for a persistent injection of subheadings, leaders, and captions in various type-faces, fonts, and type size which the reviewer found first distracting and finally irritating. A second personal adverse reaction was to the collection of all references and explanatory notes, of which there are no less than 360 (28 pages), at the end of the book. If to print footnotes at the bottom of the page is too expensive, and they must be put at the end of the volume, at least there might be running chapter numbers on each leaf. To have such minor items, including many proof-readers' errors, mar so excellent and fine a book is regrettable. Fortunately, this can be rectified when a second edition appears. Incidentally, the readability of the book is of such high order that these defects were not noticed by the reviewer until he read the work a second time. The book is well indexed and has an excellent bibliography.

M. C. SHELESNYAK

JAMES LIND, *Founder of Nautical Medicine.* *By Louis H. Roddis. Henry Schuman, New York.* $3.00. xii + 177 pp. + 8 pl. 1950.

The enjoyment of reading what an author has created with enthusiasm, devotion, and love is great, especially when such feelings are developed into an intelligent and critical analysis of his subject. Louis Roddis has written with restrained admiration and affection more than just the biography of James Lind (1716–1794), Surgeon in the Navy of King George the II, and First Physician of the Royal Hospital at Haslar. He has fashioned out of the fragments of this personal history the exciting story of nautical medicine; and has shown the importance of naval medicine to the history of medicine and biology. Lind's contributions to the problems of scurvy, of shipboard hygiene, water physiology, and of tropical medicine are woven into the history of naval medicine with delicate skill.

James Lind entered medical apprenticeship to Dr. George Langlands at the age of 15 and eight years later, in 1739, joined the British Navy as a surgeon's mate. During his long naval experience he demonstrated the efficacy of fresh fruit, and in its absence of lemon juice, in preventing and curing scurvy. He carried out the first distillation of sea water aboard ship. He introduced rules for the prevention of ship-fever (typhus) and for ship hygiene in general. His most important writings are classics that influenced greatly the trends of medicine. *A Treatise on Scurvy* (First edition: vi + 456 pp. 8°. Sands, Murray, & Cochrane, Edinburgh, 1753) showed the way for the conquest of scurvy —a disease which did more damage to the naval and merchant fleets than combat actions. *An Essay on the Most Effectual Means of Preserving the Health of Seamen in the Royal Navy* (First Edition: 1757; and particularly the 3rd ed. xx + 363 pp. 8°. J. Murray, London, 1779) was a significant milestone in the evolution of preventive medicine. Its rules were soon applied to civilian hospitals by John Haygarth of Chester (1784) and greatly championed by John Howard—philanthropist and prison reformer—in improving the living conditions in 18th century jail houses. *An Essay on Diseases Incidental to Europeans in Hot Climates* (1768, First ed.) opened the campaign for the attack on the diseases of the tropics. Five editions were published during Lind's lifetime; a 6th in 1808.

Captain Roddis, (MC) USN, who tells this fascinating narrative, is well qualified, for added to his enthusiasm and affection for the subject is his long-time study of the history of naval medicine, his services as Editor of the *U.S. Naval Medical Bulletin* (now merged), as the Chief of Publications of the Bureau of Medicine

and Surgery, and as editor of the official *U.S. Naval Medical History of World War II*.

This biography of Lind is another in the ever-growing, exciting series, The Life of Science Library, for which Henry Schuman, publisher, and its advisory board, merit high praise. The typography and printing are first rate. The index is brief but adequate, and the bibliography of source material is well chosen. Roddis has included what is probably the first complete bibliography of the works of James Lind. This will be of special interest to the bibliographer.

M. C. SHELESNYAK

JOSIAH WILLARD GIBBS. *The History of a Great Mind. By Lynde Phelps Wheeler. Yale University Press, New Haven; Geoffrey Cumberlege, Oxford University Press, London.* $4.00. xii + 264 pp. + 1 pl. 1951.

Wheeler has contributed in this volume an interesting and lucid presentation and interpretation of Gibbs' personal and intellectual achievements. He has had access to materials not available to former biographers of Gibbs, and he has made good use of them. It is particularly to his credit that he has succeeded in portraying so clearly and intelligibly the content, quality, and development of Gibbs' thought, the significance of which fortunately no longer requires particular defense.

Wheeler was himself a student of Gibbs, and is thus in some ways in a strategic position to assay a critical analysis of his thinking. Whether a man's student, however, can ever write of him the truly definitive biography is difficult to know. Wheeler describes his own effort as truly the labor of love which it represents, and he clearly has more than love to qualify him as biographer. A biographer's insight into the personality and mentality of the figure he is recreating is proportional to the directness of the relationship between writer and subject. Biography is in its nature subjective; and whether a hero's disciple can temper the essential subjectivity with requisite detachment is a question that is capable of several answers. In any case, Willard Gibbs is by all odds the towering figure in the ranks of American theoretical scientists, and Wheeler's biography is the first to take full measure of his intellectual stature. As such, it demands the attention of all scientists whose fields border on thermodynamics—and who does that not include?

JANE OPPENHEIMER

THE YOUNG NATURALIST

FAVORITE BIRDS OF AMERICA.

Engravings by John J. Audubon; text by Kenneth D. Morrison. Grosset & Dunlap, New York. $1.00. 28 pp.; ill. 1951.

FAVORITE ANIMALS OF AMERICA.

Engravings by John J. Audubon and his son, John Woodhouse Audubon; text by Kenneth D. Morrison. Grosset & Dunlap, New York. $1.00. 28 pp.; ill. 1951.

THE BIG BOOK OF ANIMALS EVERY CHILD SHOULD KNOW.

By Dena Humphreys; pictures by Rudolf Freund. Grosset & Dunlap, New York. $1.00. 25 pp.; ill. 1951.

Picture books have a strong eye-appeal for children, and an increasingly large number of such volumes are entering the trade. These three, each measuring 9 x 13 inches, are likely to be successful because of their colorful treatment. The Audubon books, containing 28 illustrations each, provide the child with selections from his *Birds of America* and *The Viviparous Quadrupeds of North America*. The reproductions are in general less colorful, fuzzier, and darker than one finds in the usual Audubon print, so that much of the detail is lost in those plates, for example, of the crow, the purple grackle, and the yellow-bellied sapsucker. Nevertheless, the child will gain much pleasure from them, as well as from the brief text by Kenneth D. Morrison which accompanies each print. *The Big Book of Animals* is excellent in every respect. Rudolf Freund's pictures are extraordinarily detailed and rich in color, and Miss Humphreys' text is sprightly and informative. Text and illustration complement each other in a most commendable fashion.

C. P. SWANSON

WILD HORSES OF THE RIO GRANDE.

By George Cory Franklin; illustrations by William Moyers. Houghton Mifflin Company, Boston. $3.00. x + 181 pp. + 8 pl.; text ill. 1951.

The author, who knows his way around the Southwest as few men do, can tell a good story, and he is at his best when his subject matter is horses. In 12 different stories, with no two alike in any way, he conveys much of the flavor, the excitement, and the hardships of the early ranch days while at the same time he keeps up a sustained pace in each of his narratives. No story is forced, yet each has its own element of drama, the relationship of man and horse providing a central theme which holds the stories together. In addition, the author has added an introductory section in which he defines the meaning and origin of many ranch terms, tells of the old cattle ranches and how they came to be, and describes the training of cow horses. This is an excellent book for the imaginative boy.

C. P. SWANSON

THE WHITE-TAILED DEER.

By Olga Townsend; illustrated by Nils Hogner. Whittlesey House, McGraw-Hill Book Co., New York, London, and Toronto. $2.50. 224 pp.; ill. 1951.

This is a child's novel of the friendship between a boy and two fawns. It is a pleasant story, but contains little in the way of natural history.

ECOLOGY AND NATURAL HISTORY

PRINCIPLES OF GEOCHEMISTRY.

By Brian Mason. John Wiley & Sons, New York; Chapman & Hall, London. $5.00. x + 276 pp.; ill. 1952.

Geochemistry is a stimulating subject that deals with the distribution and its change with time of the elements throughout the earth. It is based principally upon analyses, which can be tedious, and extends reasonable assumptions to, and perhaps far beyond, their limits. Mason develops the subject with a refreshing awareness of the guiding principles of physical chemistry and crystallography as points of departure. His treatment is very clear at all points and is scholarly in its thoroughness. An unusual feature is a thumbnail sketch of contents given after each of the pertinent references. The developing jargon is defined.

The result is both a good textbook—really the first on geochemistry—and also an abridged source-book for those preparing to go deeper. I enjoyed it, even though —or perhaps because—I would be willing to argue about some point in each chapter. The origin of life took only one page!! The publishers are to be commended for keeping the price low and the quality of printing high.

STERLING B. HENDRICKS

THE BRITISH ISLANDS AND THEIR VEGETATION. *New Edition, in 2 volumes.*

By Sir A. G. Tansley. Cambridge University Press, London and New York. 63s. Vol. I: xxxviii + pp. 1–484; 93 pl. Vol. II: xxxviii + pp. 485–930; 69 pl. 1949.

Scarcely more than five per cent of Great Britain is in woodland, including forest plantations. This is a smaller proportion of the area than in any other country of Europe. In contrast, over fifty per cent of the land is in grass, the result of clearing and grazing. Aside from cultivated crops, the rest is occupied by: (1) heath, a plant formation of poor soils dominated by dwarf ericaceous shrubs; (2) moss or bog, related to heath but limited to permanently wet soils; (3) the arctic-alpine formation occurring at altitudes over three thousand feet; together with (4) miscellaneous vegetation of special restricted habitats, such as salt marsh, dunes, etc. About these and other facts a large volume of information is given in this work on the British Islands and their vegetation. First, one finds a treatment of the background or environment, in chapters that cover the geology, physiography, climate, soils, and animals of Britain. Tansley then presents a discussion of the nature of vegetation and the methods of classifying it. This is helpful to those who are new to literature on vegetation, and it serves likewise to clarify Tansley's own usage for those already familiar with an unfortunately confused terminology. For the ecologist, too, there are some additional paragraphs in the Preface that serve to clarify his concepts. The American ecologist will be interested particularly, in this connection, in the author's statement that Clements' terms for vegetation are "just as inconvenient as some of the awkward and cumbersome systems that are used on the continent, though they are more interesting because they represent attempts at dynamic interpretation." The postglacial history of Britain is treated in two parts: the prehistory, and the historical period. The American reader will find in the latter two most interesting aspects: first, an enrichment of his earlier study of the history of the British Islands, coming back to it from a new direction; second, a basis for an interpretation of the relative stage of land use to which his own country has progressed. He will find his own vegetational environment back a good many years in British history. In the end, after carefully reading through this large, 2-volume descriptive publication, the reader will have an excellent and rather complete picture of the vegetation of the British Islands and many of the environmental features which control it.

M. F. BUELL

THE SELECTION OF TREE-SPECIES. *An Ecological Basis of Site Classification for Conditions Found in Great Britain and Ireland.*

By Mark L. Anderson. Oliver & Boyd, Edinburgh and London. 12s. 6d. xvi + 151 pp. + 16 pl. 1950.

This little book is concerned chiefly with indoctrination of the popular reader into the ecological rule-of-thumb methods by which sites suitable for the planting of various tree species in the British Isles may be determined. Sufficiently generalized silvical descriptions of a number of indigenous and of some exotic tree species are given so that the reader may feel equipped to indulge in silvicultural guessing games.

Some few errors of fact in respect to North American tree species appear. For example, the natural distribution of Douglas fir is said to cover "an immense range from Alaska to South Carolina."

The book will doubtless prove of general interest and some usefulness to English landowners, but will be of little practical value to managers of American woodlots.

SCOTT S. PAULEY

JOHN BURROUGHS' AMERICA. *Selections from the Writings of the Hudson River Naturalist.*

Edited by Farida A. Wiley; Foreword by Julian Burroughs; illustrated by Francis Lee Jaques. The Devin-Adair Company, New York. $4.00. xvi + 304 pp. + 1 pl.; text ill. 1951.

One of America's 19th Century naturalists, Burroughs wrote voluminously of his wanderings and observations in the Hudson River and Catskill areas. Like most journalists of this sort, he had his moments of good, and also of not so good, writing. Miss Wiley has done a service in selecting his finer passages and gathering them together in a single volume. Burroughs was an uncommonly keen observer of woodland ways and things, and he could on occasion describe what he saw with uncommon talent. Even so, the book is not one to be read continously. There is a gentle sameness about his style that lulls the senses after a chapter or two, and one longs for the sharpness and brilliance of Thoreau to enliven the even passages. Francis L. Jaques has added much to the volume with his beautifully executed black and white sketches.

C. P. SWANSON

THIS FASCINATING ANIMAL WORLD.

By Alan Devoe. McGraw-Hill Book Company, New York. $3.75. xi + 303 pp.; ill. 1951.

Stories of animal doings have crept into our language and folklore, and have added to each a color we appreciate even though we may ignore, or be unaware of the validity of, the basic facts. Horsehairs turning to snakes, toads producing warts, elephants that never forget—these, and a hundred other beliefs, are accepted or questioned according to the background of the individual. To these topics Alan Devoe addresses himself, and the result is an extremely readable book. An apparently orderly man, the author classifies his subjects well, and then subdivides each chapter with italicized questions to be answered. These are approached with ease and assurance, although where doubt enters in, the author never hesitates to say that a definitive answer is not yet possible. The simplicity of arrangement, the index for quick reference, and the pleasant style commend this book to the layman or non-biological scientist.

C. P. SWANSON

INSECT NATURAL HISTORY.

By A. D. Imms. The Blakiston Company, New York, Philadelphia, and Toronto. $5.00. xviii + 317 pp. + 72 pl.; text ill. 1951.

This is another of The New Naturalist Series dealing with British natural history. In every way it is as excellent as the others of the series that have already appeared. The author, whose *Textbook of Entomology* is a standard the world over, was one of the most distinguished of modern entomologists. In the best sense this is a *natural history* of insects, not a manual of taxonomy and anatomy. Of the 13 chapters, 10 are devoted to what insects do and how they do it, under such headings as Wings and Flight, Senses, Feeding Habits, Biological Control, Insect Galls, Protection, Reproduction, Aquatic Insects, and Social Life. The clearly written text avoids undue technicality. I should say that this book will prove of the greatest value to anybody with a genuine interest in any phase of insect life, and will be an invaluable source of both facts and ideas for any serious student or teacher of biology from grade school to the university level. The fact that it covers the British insect fauna makes little difference. So close is the relationship between this and a large part of our North American fauna that many of the genera and, in fact, some of the species covered occur here as well. The illustrations are excellent; the color plates in particular, both in the photography of Mr. Beaufoy and in reproduction, surpass nearly anything produced in this country. To an unfortunate editorial policy must be laid the one major fault, a complicated system of numbering the plates, which are so scattered through the book that reference to them from the text is a major task.

ALEXANDER B. KLOTS

AMERICAN SOCIAL INSECTS. *A Book about Bees, Ants, Wasps, and Termites.*

By Charles D. Michener and Mary H. Michener. D. Van Nostrand Company, Toronto, New York, and London. $6.00. xiv + 267 pp. + 64 pl. 1951.

Ants, some wasps and bees, and the termites differ from most insects by their remarkably complex and well integrated family life. Entomologists term them the "social insects," for their families frequently form populous colonies or societies in which the mother insect and her young share and divide the labor of raising additional broods. The Micheners' book is today the only comprehensive popular work in English that collects together the biology of these remarkable insects. With its readable style, generous collection of illustrations, and quite sound guidance to the more detailed and technical literature, it is a pleasant book that will charm and interest laymen, naturalists, and general biologists. For the more advanced student or naturalist, who is at home with the subject, it is still a useful work, although disappointing in its final chapters.

The introductory chapter defines what is meant by a social insect, discussing in general terms the biology and relationships of social insects to asocial and subsocial forms. Thereafter the book treats consecutively social

vespid wasps, social bees, ants, and termites, and the related subsocial cousins of each. Illustrating this main body of the text, and scattered throughout the book, are numerous plates in color and in gravure. All are photographs, and they illustrate reasonably well the habitus of various social insects, aspects of their life histories, products of their constructive efforts, and so on. Concluding the main text are 2 very slight chapters devoted respectively to insects that live in the nests of social species, the so-called "guests," and finally to a comparison of the societies of insects and man. Thereupon the book closes with a brief appendix on the structure and classification of insects, a selected bibliography for those who would know more about these incredible and industrious insects, a short but useful glossary of technical terms employed in the text and, finally, the index.

On the whole the text is informative and reasonably accurate, certainly well above average for a popular work. It does not pretend to add new observations aplenty, and the accounts that are given are certainly well selected from the original literature and often nicely tempered by the Micheners' long and varied field experience. For the general reader there is little to criticize here, except possibly the lack of balance between illustrations and text. Vespids are given perhaps 11 per cent of the general text, yet fully a third of all illustrations (and nearly half of the color figures) are of one or another aspect of vespine biology. Instead of a large variety of forms being shown, members of a single genus or species may be repeatedly figured, with little or nothing new revealed in succeeding illustrations. Zoraptera, bugs, roaches, earwigs, embiids, and beetles are mentioned or discussed as interesting subsocial types, yet how meaningless some of these names must be without adequate description or any illustration to aid comprehension by the non-entomologist. While many of the illustrations are admirable, some are poor (at least as reproduced in the review copy), and in a number of cases unfortunate errors have crept in. [For example, the egg stage has been trimmed from Fig. 48; order is reversed between legend and illustration of Fig. 49; Figs. 74 and 75 very probably represent *Camponotus*, and not *Lasius* or *Formica*, as labelled.] Slips in the text are relatively few, mostly inconsequential, and will be caught by the careful reader.

As intimated above, the treatment of the guests of social insects is extremely superficial and unrewarding. Indeed, in its present form the few pages of this chapter could well be omitted from the text without noticeable loss. The final chapter, comparing the families of these so-called social insects with the societies of man, is also shallow and fraught with what seems to me to be specious analogy. While not wishing to imply that much value can come from the comparison of ant, wasp, bee, or termite colonies with human cultures, an eager anthropologist could greatly increase the list of analogical correspondences between particular insect and human societies. What the Micheners seem not to have realized is that they are comparing *one* particular society of man, namely, that characterized by Western culture, with many different kinds of insect society.

Van Nostrand seems not to have given the same good quality of paper to the Micheners' book as it did to Gertsch's *American Spiders*, and this may in part explain the reduced price of this most recent member of The Illustrated Naturalist Series. As with Gertsch's book, the publishers once again count each separate figure as a "plate" in their advertising matter (as in the jacket blurb). Despite Van Nostrand's claim that *American Social Insects* contains 30 plates in color and 79 in gravure, expect no more than 16 color plates and 48 in gravure when your copy of the book arrives.

KENNETH W. COOPER

IN TIME OF SWALLOWS. *Fifty-two American Birds. Poems by Mae Winkler Goodman; illustrations by William E. Scheele. The Devin-Adair Company, New York.* $2.75. vii + 54 pp.; ill. 1951.

It is not often that a reviewer of biological books undertakes the evaluation of a book of poetry, even though the subject of the poems may be exclusively biological. But reviewers are a brazen lot, in general admitting of no inadequacies. Mrs. Goodman has given us over 50 short verses, each one conveying her impressions of one or another of our native birds. They are essentially descriptive in content, light and airy as a bird on the wing, and dependent for effect on a happy turn of words, a subtle simile, and an accurate portrayal of those characteristics, peculiar to a species, which instantly identifies the bird to one who has seen it in its native habitat. It is this aspect of her poetry which indicates that Mrs. Goodman knows her birds from first-hand observation, for these subtleties of character are never obvious to the casual passerby. As to the technical qualities of the poems I can say nothing, except to point out that recurring images and moods lead to a monotony if too many are read at a single sitting. However, they evoke, on reading, the memory of a bird once seen and now recalled with greater clarity and a warmer sense of kinship, and they reinforce what you yourself may have seen and known but could not put into words.

C. P. SWANSON

THE BIRDS ARE YOURS. *By Robert S. Lemmon; illustrations by Don Eckelberry. The Macmillan Company, New York.* $2.25. vi + 121 pp.; ill. 1951.

Any animal becomes more fascinating as an individual

as one's acquaintance with it becomes more intimate. The birds, because of their close association with human habitation, are more accessible for study, and the popularity of bird clubs is recognition of this. Considering this fact, the authors, through text and illustration, have attempted to bring the more intimate and personalized traits of various birds to the attention of the outdoor-minded layman. The text is informal and personal, the black and white illustrations nicely complementary, and the topics sufficiently diversified and selective to make for easy and pleasant reading.

UNION BAY. *The Life of a City Marsh.*

By Harry W. Higman and Earl J. Larrison; illustrated by Edmund F. Sawyer. University of Washington Press, Seattle. $4.00. viii + 315 pp.; ill. 1951.

Union Bay describes the life of a salt-water marsh at the edge of the campus of the University of Washington. The authors, writing in the first person singular, base their book upon a long series of observations made during numerous canoe trips into the marsh. Their style is casual, each chapter describing and discussing various aspects of the ecology of the marsh, particularly that of its birds and mammals. The main conclusion to be reached from reading the book is that considerable pleasure is available to the amateur city-bound naturalist who will make an intensive investigation of the wild areas that exist within the confines of his city. This conclusion emphasizes the recreational value of small refuge areas in thickly settled regions. The authors are in general reasonable in their statements regarding the relations of wildlife and man, and realize the need for sound wildlife management policies in determining these relations. They are at their best in describing the animals as they meet them in the marsh. The analogies between the activities of these animals and those of humans should have been avoided. However, such are not too frequent. An air of lightness and pleasant humor pervades the book, as in the description of the ecology of the empty bottles that float into the marsh with the tide, and of the fishermen that invade the marsh in the spring. The potentialities of city marshes as wildlife refuges are well illustrated by the chapter telling of a weasel, a mink, two otter, a beaver, and several muskrats that were all seen in one day in sight of the University football stadium.

JOHN CUSHING

BIOLOGY OF THE WHITE CRAPPIE IN ILLINOIS. *State Ill. Dept. Regist. Educ., Nat. Hist. Surv. Div. Bull., Vol. 25, Art. 4. August, 1951.*

By Donald F. Hansen. Illinois Department of Registration and Education, Urbana. Paper. iii + pp. 211–265 + 1 pl.; text ill. 1951.

EVOLUTION

DARWIN IS NOT FOR CHILDREN.

By Vera Barclay. Herbert Jenkins, London. 9s. 6d. 256 pp. 1950.

The author believes that children are being taught evolution from a biased point of view, not being given enough information about the possibility of a special creation. She herself believes that God created all the animals (and plants?) in the past, and that natural selection has acted in keeping them true to type. She admits that some animal species have become extinct but holds that present animals are ". . . his final animal creation." She does believe, however, that animals are capable of further adapting themselves, up to a point. Inasmuch as she notes that this point allows a latitude of adaptive changes ranging through all the series of fossils known to be involved in the evolution of the horse, the author's views appear to be sufficiently illogical and self-contradictory to invalidate themselves without the need of drawing upon further evidence. This is borne out by a variety of other statements throughout the book.

The only recommendation to be made is that the book may be useful to "children" in college seminars as a contemporary example of the illogical nature of the views of anti-evolutionists.

JOHN CUSHING

GRUNDFRAGEN DER PALÄONTOLOGIE. *Geologische Zeitmessung—Organische Stammesentwicklung—Biologische Systematik.*

By Otto H. Schindewolf. E. Schweizerbart'sche Verlagsbuchhandlung (Erwin Nägele), Stuttgart. DM. 49.60 (cloth); DM. 47.00 (paper). 506 pp. + 32 pl.; text ill. 1950.

DER ZEITFAKTOR IN GEOLOGIE UND PALÄONTOLOGIE. *By Otto H. Schindewolf. E. Schweizerbart'sche Verlagsbuchhandlung (Erwin Nägele), Stuttgart.* DM. 9.60 (paper). 114 pp.; ill. 1950.

Schindewolf, in a small book published in 1936, was the first person to attempt a genuine general synthesis of evolutionary genetics and paleontology. For its time that was an original and brilliant achievement. Its bases were early mutationist theory, along the lines of De Vries, and typological systematics. The pioneering publication was followed by various still shorter studies, which indicated that Schindewolf was developing his theory further but did not give evidence or argument in detail. Full documentation is now provided in the third section—much the longest of four—of his new, large book on basic problems of paleontology.

In the meantime genetics and systematics have advanced far beyond the bases used by Schindewolf in his first attempt at synthesis. Population genetics has developed from strictly Mendelian genetics, or the

genetics of the individual. Without noteworthy exception, population geneticists have abandoned strictly mutationist, Devriesian, or saltatory theories of evolution. For them, evolution is a matter of genetic changes in populations influenced by natural selection, among other factors. With less but increasing unanimity, both paleontological and neontological systematists have similarly abandoned typological in favor of population systematics. The new genetics and the new systematics have worked out a synthesis of evolutionary theory quite different from that earlier and perhaps prematurely made by Schindewolf.

Schindewolf is aware of these developments. (He cites Dobzhansky, Heberer, Mayr, Rensch, Simpson, and Wright, although he has misunderstood Wright's views; he does not cite Fisher, Haldane, Huxley, or Muller.) Nevertheless, he now merely elaborates his original theory under the name of "typostrophism," and is quite untouched by any more recent work in genetics or systematics. For him, systematic units are still definable as idealistic "types" rather than as varying groups of material populations. His "types," and hence his systematic units, are firmly believed to arise by single, saltatory mutations, not by selection-influenced accretion of genetic changes in populations. A mutation acting early in ontogeny is supposed to produce in one step a new phylum, class, or order. Acting later in ontogeny, it is supposed to produce a new family, genus, or species. Each category is seen as arising as such, and not by any accumulation of changes of lesser systematic rank.

The typological approach and its concomitant "typostrophism" are central in all of Schindewolf's thinking on systematics and evolution, but numerous ancillary theories are also involved in his long, complex thesis. Among these are: the universal occurrence of evolutionary cycles, and inherent racial life cycles; the common appearance of new characters by "proterogenesis," which is essentially an old friend, neoteny, under a new name; and orthogenesis as undeviating, intrinsic direction of evolution.

An old issue is thus boldly posed in new terms: typology *versus* population concepts; evolution governed by mysterious internal factors *vs.* an interplay of (in the main) mutation and selection; catastrophic origin of individual "hopeful monsters" *vs.* secular change in populations. That issue has already been discussed at very great length by very many students. A consensus opposed to the old typological schools has developed to such a degree that Schindewolf's views begin to seem merely anachronistic. To go over the arguments again here is unnecessary and, indeed, impossible. A review of reasonable length can only consider whether the position is substantially changed by Schindewolf's fuller and more definitive statement. In the reviewer's opinion, it is not. Schindewolf has not successfully faced and answered the many criticisms of his theory, nor has he adduced any cogent, correct new evidence.

The most controversial aspects of Schindewolf's new books have been stressed, which is fair because he also stresses them. The books reflect his great erudition and contain much else that is unqualifiedly valuable. Even the most controversial parts and those least likely to be accepted by other students are highly stimulating, just as his initial work in this field was one of the stimuli for the modern synthesis, to which he is himself so bitterly opposed.

The second, smaller book (an expansion of an inaugural lecture on his assuming the chair of geology and paleontology at Tübingen) is, in a sense, an elaborate footnote to the first. It has the fault or virtue, as you wish, of assuming the truth of "typostrophism." Beyond this it has the unquestionable virtue of providing and summarizing many data on rates of evolution and their distribution, on over-all aspects of the movement of evolution, and on other broad topics. Such data are valuable and suggestive regardless of any particular theory.

Study of these books is strongly recommended to all students of paleontology or evolution. Duty compels that the recommendation be accompanied by a warning not to rely on all statements without corroboration. Examples: the "orthogenetic" series of Fig. 267, p. 332 in the *Grundfragen* is constructed by taking animals from wholly different lines of descent and placing them in a false temporal sequence; the statement quoted from Dietrich about lack of a transition in the horse family, pp. 72–73 in *Zeitfaktor* . . . , is flatly contrary to known facts.

G. G. Simpson

Some Jurassic and Cretaceous Crabs (Prosoponidae). *Bull. Brit. Mus. (nat. Hist.), Geol., Vol. I, No. 6.* *By T. H. Withers. British Museum (Natural History), London.* 5s. (paper). Pp. 171–192 + 3 pl.; text ill. 1951.

The early Middle Jurassic crabs *Pithonoton richardsoni* and *Prosopon mammillatum*, the Lower Cretaceous *Mithracites vectensis*, and the Upper Cretaceous *Rathbunopon woodsi* (n. sp.) are subjected to a study of their structure, and their evolutionary relationships are clarified. *Pithonoton* and *Prosopon* show the derivation of the Prosoponidae from the earliest known crab, *Eocarcinus* of the Lower Jurassic.

Cretaceous and Eocene Peduncles of the Cirripede Euscalpellum. *Bull. Brit. Mus. (nat. Hist.), Geol., Vol. I, No. 5.*

By T. H. Withers. British Museum (Natural His-

tory), London. 5s. (paper). Pp. 147–170 + 4 pl.; text ill. 1951.

Some curious fossils from the Upper Cretaceous of South Island, New Zealand, and from Graham Land, as well as from the Upper Eocene of Tierra del Fuego, are shown to be the monstrously developed peduncles of a cirripede. Similar peduncles occur together with capitular valves in the same strata in the Mississippi and Texas Middle Eocene, and enable identification of the fossils to be made. They belong to the Recent genus *Euscalpellum*, new among fossils.

THE ANCESTRAL CROCODILIAN PROTOSUCHUS. *Bull. Amer. Mus. nat. Hist., Vol. 97, art. 3.*

By Edwin Harris Colbert and Charles Craig Mook. American Museum of Natural History, New York. 75 cents (paper). Pp. 143–182 + 8 pl.; text ill. 1951.

Protosuchus richardsoni was found in 1930 in the Dinosaur Canyon beds (Upper Triassic-Lower Jurassic) of Arizona. It is a small, definitely primitive crocodilian, about 1 m. in length. Portions of 8 specimens, the type specimen a nearly complete skeleton, were available for study. Certain thecodont characters have been retained in *Protosuchus*, but are secondary in importance to the crocodilian features of the genus. Parallel evolution may have been responsible for some of the resemblances between *Protosuchus* and thecodont genera such as *Aetosaurus* and *Stegomus*. Resemblance of *Protosuchus* to the S. African genera *Notochampsa* and *Erythrochampsa* is sufficiently close to warrant inclusion of the 3 genera in a single family.

PHENACOCOELINAE, A NEW SUBFAMILY OF OREODONTS. *Contribution to the Revision of the Oreodonts (Merycoidodontidae), No. 5. Bull. Amer. Mus. nat. Hist., Vol. 95, art. 3.*

By C. Bertrand Schultz and Charles H. Falkenbach. American Museum of Natural History, New York. 75 cents (paper). Pp. 87–150; ill. 1950.

A new subfamily of oreodonts, one known almost entirely from the Lower Miocene (Western N. America), has been set up to include 4 genera: *Phenacocoelus, Hypsiops, Submerycochoerus,* and *Pseudomesoreodon*, the last three being new genera. Altogether 85 specimens were available for study. These represent 12 species, of which 2 *Phenacocoelus*, 2 *Hypsiops*, and 3 *Pseudomesoreodon* are new. The paper does not consider the broader relations of this group of artiodactyls.

STERKFONTEIN APE-MAN—PLESIANTHROPUS. *Part I: Further Evidence of the Structure of the Sterkfontein Ape-Man Plesianthropus. Part II: The Brain Casts of the Recently Discovered Plesianthropus Skulls. Transvaal Mus., Mem. No. 4.*

By Robert Broom and J. T. Robinson (Part I) and G. W. H. Schepers (Part II). Transvaal Museum, Pretoria. 17s. 6d. 117 pp. + 8 pl.; text ill. No date [1950].

This monograph supplements Broom's book of 1946 on the *Australopithecidae*, and describes specimens recovered between 1946 and 1950. The first section of the volume provides anatomical descriptions of a series of four fossil skulls and a mandible, of certain deciduous and permanent teeth, and of some post-cranial bones, all of which are assigned to the genus *Plesianthropus*. Other chapters deal with the geological age of these fossils and with their phylogenetic significance. The second section (by G. W. H. Schepers) describes the endocranial casts of the fossils.

Broom has taken the opportunity provided by the monograph to reiterate his belief that "it was from a member of this family . . . or a closely allied form, that man arose," and that *Plesianthropus* was "nearly human." Schepers endorses this view with the statement that the brain of the Australopithecinae, although "neither Simian nor Human" was "very close to the latter."

The methods used by Broom and his associates in assessing the morphological characteristics of these fossils are the more limited ones of conventional anatomy, and many of the claims they make about the phylogenetic significance of the fossils have to remain sub judice because of their failure to test their observations critically with the help of the newer tools which biometric and statistical methods have placed in the hands of the physical anthropologist. Students of the subject are, however, deeply in debt to the late Dr. Broom for the great enthusiasm which inspired his life's work, and for the fact that without him we probably should not have known today a half of the anthropoid fossils that are now available for study.

S. ZUCKERMAN

GENETICS AND CYTOLOGY

THE SCIENCE OF HEREDITY. *The Thinker's Library, No. 139.*

By J. S. D. Bacon. Watts & Co., London. 3s. 6d. (paper). viii + 192 pp.; ill. 1951.

WHAT'S ALL THIS ABOUT GENETICS? *An Explanation Of Inheritance In Plants And Animals (Including Man Himself) for the Ordinary Reader. Thrift Books No. 3.*

By Rona Hurst. C. A. Watts & Co., London. 1s. (paper). 124 pp.; text ill. 1951.

These two British paper-bound books written in semi-popular style are totally different. Bacon's book is a well written presentation along classical lines of the

major principles of genetics. The main omission is population genetics, about which a small amount of information is scattered here and there without much attempt to organize it into a whole. Two chapters are devoted to a somewhat miscellaneous though fairly satisfactory account of gene action and the nature of the gene. Chapter II, Arguments against Genetics, is a poorly integrated discussion of the inheritance of acquired characters, cytoplasmic inheritance, quantitative inheritance, heterosis, and Lysenko. This, to my mind, is far and away the worst chapter in the book and suffers from the attempt to combine subjects whose connections, if any, were not clearly thought through. On the whole, notwithstanding such weaknesses, this book can be recommended to the intelligent layman with the certainty that it will give him a satisfactory understanding of the basic principles of the subject and will stimulate him to think about some of the more modern developments.

The book by Hurst is not satisfactory. It puts unduly great emphasis upon the early work in the field, especially the early British work, and its whole center of interest is upon problems of an earlier day. The presentation is rambling and is frequently sidetracked into unimportant matters. While some attempts are made to introduce recent work, this is done in a manner which suggests that it was not thoroughly understood. Thus the reader is not given a clear idea either of classical genetics or of the more modern developments in the field.

R. F. KIMBALL

UNITÉS BIOLOGIQUES DOUÉES DE CONTINUITÉ GÉNÉTIQUE. *Paris, Juin-Juillet 1948. Colloques int. Centre nal. Recherche scient., VIII.*

Centre National de la Recherche Scientifique, Paris. 1000 fr. (paper). 205 pp. + 6 pl.; text ill. 1949.

This publication contains 16 excellent and important contributions on a topic of paramount importance in biology, the problem of the nature and mutability of cell structures which are replicable. These contributions are on the following subjects: the kinetosomes of the Protista (A. Lwoff); the determinants of antigenic characters in *Paramecium* (T. Sonneborn and G. H. Beale); plastids (M. M. Rhoades); 2 papers on *Pneumococcus* transformations (H. E. Taylor; R. D. Hotchkiss); the specificity of nucleic acids, particularly in the bacteria (A. Boivin, R. Vendrely, and R. Tulasne); variations in plant viruses (F. C. Bawden); bacteriophage genetics (M. Delbrück); lysogenic staphylococci (P. M. Rountree); genoids in *Drosophila* that produce sensitivity to CO_2 (Ph. L'Héritier); plasmagenes (C. D. Darlington); the nutrition of certain normal and pathological vegetal tissues (R. J. Gautheret); the role of buds in histogenesis (G. Camus); the plasmagene hypothesis in development and differentiation (J. Brachet); the action of acriflavin on yeasts (B. Ephrussi); and specific genetic and chemical factors in the synthesis of bacterial enzymes (J. Monod). Work on most of these problems has been carried considerably farther since the date of this publication. Nevertheless, as a comprehensive view of this new field of interest, which, as Lwoff puts it, has become "l'un des plus passionants de la biologie," the volume has lasting value. It brings together all of these numerous observations of "units endowed with genetic continuity"—a far more appropriate characterization, by the way, than the customary but erroneous appellations "self-duplicating" or "self-reproducing" units. The brief summary by Lwoff is particularly helpful. It points out the similarities and dissimilarities of the normal and pathogenic varieties; it stresses the relation between mutability and, on the one hand, the specificity of desoxyribose nucleic acids and genes, and, on the other, the influence of external agents; and finally, it indicates how the problem of the replication of such units may be clarified by analyzing the behavior of adaptive enzymes.

It is somewhat unexpected and worth noting that, although half of the participants in the symposium were English-speaking, all of the papers appear in French.

BENTLEY GLASS

PAPERS IN MICROBIAL GENETICS: BACTERIA AND BACTERIAL VIRUSES.

Selected by Joshua Lederberg. University of Wisconsin Press, Madison. $3.75 (paper). xx + 303 pp.; ill. 1951.

In this paper-covered compendium, Lederberg has attempted to include some of the most important of the papers published in the past 10 years in the field of bacterial and viral genetics. This volume will be an invaluable addition to the library of student and instructor alike, since it provides an immediate source of a representative collection of papers within the field. It is at present being used in a course in microbial genetics at the University of Wisconsin, and could indeed be profitably used at any school where such a course is taught. The limitations of a book such as this are only those which appear where, of necessity, a certain number of papers must be left out due to restrictions of space. Although some of us may not agree as to which of the missing deserved to be withheld, there will surely be no argument concerning those which appear.

STANLEY G. FRIEDMAN

DIE CHROMOSOMENZAHLEN *der Gefässpflanzen Mitteleuropas.*

By Georg Tischler. Dr. W. Junk, 'S-Gravenhage. F. 42.50. 263 pp. 1950.

The chromosome counts of European plants are listed, with the arrangement according to the usual taxonomic classification. Basic chromosome numbers for the families are given, together with the various counts for each species, and with the authority cited. A list of references is furnished, and an alphabetical arrangement of species is provided in the back to circumvent difficulties due to taxonomic differences. The book was completed too early to have included information on the pteridophytes, and the reader may be referred to Manton's book for more up-to-date studies on this group.

C. P. SWANSON

STUDIES IN OENOTHERA CYTOGENETICS AND PHYLOGENY. *Indiana University Publications, Science Series No. 16.*

Edited by Ralph E. Cleland. Indiana University, Bloomington. $4.00. 348 pp.; ill. 1950.

The genus *Oenothera* has been of cytogenetic interest ever since DeVries put forth his mutation theory. As every biologist knows, the instability of the Oenotheras is not due to a high rate of mutability, but rather to changes occurring in the translocation- or Renner-complexes, and to polyploidy, as Renner, Cleland, and their students have shown. The present monograph is concerned with evolutionary trends in the subgenera *Euoenothera* and *Raimannia*, as detected by cytogenetic, taxonomic, and geographical studies. It consists of 7 original papers by Cleland and his students. The complexity and high frequency of races within species, each race being a more or less self-perpetuating taxonomic entity but capable of further cytological diversity, raises anew the problem of species definition in a system highly circumscribed by self-pollination and balanced lethal systems. Clearly, the genus as a whole lacks the evolutionary flexibility of cross-pollinated organisms that have a free exchange of genetic materials—the California species with large flowers, paired chromosomes, and cross pollination are primitive exceptions—but the thesis is advanced and supported that the Renner complexes are not without their own peculiar advantages for survival. Further, the long-advanced assumption that the presence of similar complexes denotes evolutionary proximity is strongly substantiated. A general summary is provided to give continuity of purpose and structure to the separate papers.

C. P. SWANSON

PLANT BREEDING.

By A. L. Hagedoorn. Crosby Lockwood & Son, London. 12s. 6d. 237 pp. + 4 pl.; text ill. 1950.

One does not have much choice among good modern textbooks on the fundamentals of plant breeding. Yet if technical treatments are few, books for the layman are indeed rare. The problems of translating the subject for the amateur who is unfamiliar with genetics or other biological prerequisites, yet of yielding information that is useful and accurate, are very challenging. Although Hagedoorn has striven hard and has treated many aspects, one cannot be altogether sure how well he has succeeded.

The text comprises 51 short chapters grouped into three sections: More Theoretical Subjects; More Practical Subjects; and Methods of Breeding and Selection in Some Special Groups. There is inevitable overlap between the first two parts. Some of the chapters—short essays on such subjects as The Material for Selection, The Choice of Plant Breeding Material, The Importance of Collections, Importation, etc.—appear in almost random order. Coherence is attempted, if none too effectively, by means of repetition; for instance, the "Ramsch" method of selection by means of survival in bulk populations is described in detail in 3 different chapters.

Needless to say, opinions will always differ about the degree of emphasis that should be placed on various aspects of such a broad subject. Yet certainly many workers will take issue with such treatment as the following: (1) The explanation of gene mutation entirely as a rearrangement of genes already existing on a chromosome; (2) presentation as a presumably commonplace phenomenon of the astounding case of parthenogenesis in squash that resulted in gametic rather than zygotic ratios; (3) minimization of the importance of self-incompatibility (even though selfing of heterozygous clones is repeatedly advocated as a means of releasing valuable variation); (4) failure to mention the extreme importance in breeding for disease resistance of striving for 100 per cent infection and of the occurrence of physiological strains of pathogens; (5) discredit of the use of any statistics save the mean and probable error. On the other hand, commendable stress is laid on many important aspects of breeding. Thus the reader should be impressed with the futility of testing F_1's, with the need for large segregating generations, and with the important bearing of the reproductive mechanisms of the crops.

The opportunity to enhance the value of the book with appropriate illustrations has not been well exploited. Illustrations are few, and some, though self-explanatory, are not integrated in the text.

The book is enlivened by the injection of frequent bits of Hagedoorn's experience with plants. Also, it is a useful reference for some of the findings of Dutch and other European workers that might not appear elsewhere, especially those concerning the breeding of tobacco, sugar cane, and other crops of the Dutch Indies.

CHARLES M. RICK

CYTOGENETICS OF THE GROUSE LOCUST, *Apotettix eurycephalus Hancock. Tech. Bull. 67, Agric. Exp. Sta., Kans. State Coll. Agric. & Appl. Sci.*

By Robert K. Nabours and Florence M. Stebbins. Agricultural Experiment Station, Kansas State College of Agriculture and Applied Science, Manhattan. Free upon request (paper). 116 pp.; ill. 1950.

This bulletin continues the records of matings and progenies from *Kansas Technical Bulletin* 17 (1925). The records of matings now cover 100 successive generations and amount to "several millions of heterozygous pairings of 19 discrete genes." The new tables add the records of matings involving a new lethal, 6 dominant and 1 recessive color patterns, and all x-ray induced anomalous chromosomes, including a dominant factor translocated to sex-linkage, and a case of doubled centromeres. Extensive crossing-over data are summarized. The extraordinarily close linkage of the 17 dominant and 1 recessive color pattern genes, and the lethal which has clearly superior viability in the heterozygous condition make the genetics of *Apotettix eurycephalus* unusual and highly interesting. Few biologists will understand the technical details in the 86-page table of matings and progenies; but few more mountainous collections of genetic data have ever been assembled, and geneticists will be well repaid by mining the rich veins of ore. Maybe the metaphor is a bad one. It might be better to speak of a monument than of a mountain.

BENTLEY GLASS

PRÉCIS DE GÉNÉTIQUE APPLIQUÉE À LA MÉDECINE VÉTÉRINAIRE.

By N. Kobozieff and N.-A. Pomriaskinsky-Kobozieff. Vigot Frères, Paris. 130 fr. (paper). 216 pp. + 15 pl. 1943.

The authors begin this scholarly work with a condensed discussion of the principles of genetics. There follow 6 divisions, each relating to applied genetics. The second division deals with the inheritance of normal or favorable characters in poultry, horses, cattle, sheep, and swine. The text is supplemented in this, as in subsequent divisions, by tables of the characters in question that give a brief description of each character, and state the dominance and recessiveness of each pair of alleles. The sexing of chickens and ducks by certain crosses involving sex-linked characters is also explained. Visible and lethal mutations in horses, cattle, sheep, goats, swine, dogs, cats, the small rodents, and poultry are discussed in the third division. Both environmental and genetic factors leading to sterility are considered in Division Four. The authors urge stock-men to use genetically tested animals as herd bulls, stallions, or cocks, since concealed lethals or sterility factors in such animals will become widely spread. Breeders are cautioned against using animals that have required therapeutic measures in order to serve as stud animals. For the reviewer the most interesting part of this book were the last 3 divisions, concerning the genetic basis of abortions, cancer, and immunity to bacterial infection. The authors have beautifully assimilated the extensive sources of original work on these subjects, including original work of their own on cancer. Each division of this work contains a bibliography; an author index and folio of illustrations appear at the end of the book. The book is valuable both as reference work and as textbook. It is not surprising to read that it won the Urbain-Leblanc award for 1942.

SARAH B. PIPKIN

L'HÉRÉDITÉ DES PRÉDISPOSITIONS MORBIDES. *L'Avenir de la Science—31.*

By Raymond Turpin. Librairie Gallimard, Paris. 450 fr. (paper). 261 pp. 1951.

Following a brief chapter on the basic principles of human genetics as related to medicine, the main body of this paper-bound and rather loosely organized French volume is devoted to a review of the present state of genetic knowledge regarding some of the most common diseases encountered in internal medicine. The conditions discussed include acute infections, chronic pulmonary tuberculosis, cancer, allergic phenomena, and rheumatic disease. The author is identified as a professor of medicine, and it is possible that this identification may have been offered with a view of explaining not only the selection of his topics, but also his occasional disinclination to separate fact and theory with respect to the various genetic mechanisms involved. Throughout the book, particular attention is given to apparent geographic and ethnic differences, to observed correlations with age, sex, somatotype, and blood groups, and to the results of previous twin studies.

With respect to pulmonary tuberculosis, the genetic factor supposed to be responsible for abnormal susceptibility to the infective agent is believed by the author to be recessive to the factor determining a high degree of resistance. This opinion is based on the observation of a high incidence of the disease in the otherwise healthy population of a small mountain village distinguished by an excessive degree of inbreeding.

In the etiology of cancer, the effect of heredity is assumed not only to constitute a specific predisposition to malignant tumor formation, but also to determine its localization, especially with regard to cancer of the uterus and the breast. The given types of cancer are explained by cytoplasmic inheritance, mainly because of a morbidity rate higher in the sisters of affected persons than in their mothers.

FRANZ J. KALLMANN

GENERAL AND SYSTEMATIC BOTANY

BOTANY OF SOUTHEASTERN YUKON ADJACENT TO THE CANOL ROAD. *Nat. Mus. Can. Bull. 121, Biol. Ser. No. 41.*

By A. E. Porsild. Department of Resources and Development, National Parks Branch, National Museum of Canada, Ottawa. $1.00 (paper). vi + 400 pp.; ill. 1951.

With the publication of this fine work, another large wilderness area in the vast Canadian subarctic has become relatively well known, botanically. The Canol Road, running from Johnson Crossing, on the Alaska Highway, northeastward to Camp Canol, in the Northwest Territory, provides access along a representative transect of the southeastern portion of the Yukon Territory. In the summer of 1944, Porsild was a member of a National Museum field party working along this road. A large collection of plants was obtained, and extensive notes were made on the vegetation, phenology, and the distribution of the flora. In the present work the results of a critical study of this material are placed on record.

An account is given of the topography and one of the physiography. (Why topography is not a part of the physiography, and why economic botany is, is not made clear.) This is followed by a summary of the history of botanical exploration of the region.

The botanical portion, proper, begins with a careful floristic description of the plant communities, both generally and regionally. As the author points out, it is too early to present a phytogeographic pattern of the region as a whole. The amount of variation on this one transect is a good indication of the complexity that this pattern will show when worked out in detail.

Floristic lists are presented for the areas along the road studied, bringing out many significant differences in composition, correlated with variations in habitat, particularly in slope, exposure, and nature of the substratum. The material presented is almost strictly factual, with little attempt at interpretation. There is also almost no description of the aspect and structure of the vegetation, and rather little about its dynamics. In his surprisingly short section on floristic analysis, the author points out the inadequacy of Hultén's floristic subdivision of the Yukon, and leans very heavily on the discussion by Raup in his *Botany of Southwestern Mackensie* (1947). He emphasizes, however, that any phytogeographic conclusions based on present knowledge are inevitably premature.

The main body of the work is an annotated catalog of the flora. This makes ample use of the monumental *Flora of Alaska and Yukon*, by Erik Hultén. Synonymy, for example, is given only in so far as there has been subsequent work, or where Porsild does not agree with Hultén.

The annotations include citations of all specimens known to the author, a discussion of the habitat and occurrence of the species, phenological notes, critical taxonomic notes, and for some species, descriptions. A number of species and subspecies are described as new, and several combinations are made for the first time.

The author's generic concepts are usually on the conservative side, and the specific limits show a vast familiarity with the plants as they grow in the field. This is quite to be expected, as there are few botanists whose field experience with the plants of northern North America equals that of Porsild. A list of literature references cited, and a complete species index are provided.

Finally, the well selected series of plates, reproduced better than is usual, give a better idea of some aspects of the vegetation and of certain of the plants than would a great amount of description.

The author and the National Museum of Canada are to be commended on this excellent presentation of the results of the exploration of a newly opened wilderness. As time goes on and floristic and vegetational changes take place along the Canol Road, this publication will serve as a reference point from which such changes may be measured.

F. B. FOSBERG

INTRODUCTION TO MYCOLOGY.

By J. A. Macdonald. Academic Press, New York; Butterworths Scientific Publications, London. $3.00. x + 177 pp.; ill. 1951.

The biologist wishing to acquire a minimum knowledge of fungi from existing textbooks of mycology is usually bewildered and confused by the volume of details. While the need for a simplified treatment of this subject has long been recognized, prior efforts in this direction have met with only limited success. Within the compass of less than 200 pages of text and 163 figures, the present author discusses mycology in general (3 chapters), myxomycetes (1 chapter), phycomycetes (5 chapters), ascomycetes (5 chapters), basidiomycetes (4 chapters), fungi imperfecti, mycorrhiza, and lichens. There is much that is good in this presentation, although many mycologists will not like one feature or another of the treatment. To this reviewer, the worst faults include reference to *Taphrina deformans* and *Claviceps purpurea* as obligate parasites, and the designation, for the sake of simplicity, of asci and basidia as sporangia, a description which is likely to create considerable confusion. With all its faults, the book appears to meet its primary objective, and may be recommended as supplementary reading to accompany courses in bacteriology and microbiology.

F. T. WOLF

THE STIPITATE HYDNUMS OF THE EASTERN UNITED STATES.

By William Chambers Coker and Alma Holland Beers. University of North Carolina Press, Chapel Hill. $5.00. viii + 211 pp.; ill. 1951.

As is always to be expected in the mycological books issued from the University of North Carolina Press, the present book is excellent. It is neat in appearance, well bound, with good type. The reproductions of the fine photographs are good, and the line-drawings of anatomical details are well done. The senior author has been publishing studies on this group of fungi, usually forming the main group of the Hydnaceae, from North Carolina and adjacent regions since 1918. In this book the junior author has contributed the bibliographical work and the plates of line-drawings.

In the area covered 10 genera are recognized, 1 of them new. This is named *Bankera* for Howard J. Banker, who made many valuable contributions to the study of this family in America in the first two decades of this century. In all, 60 species, 1 variety, and 2 forms are included, of which 2 species are described as new. A key to the genera is followed by an unusual feature, a key to the *fleshy*, stipitate species. For species that do not meet this definition it is necessary to refer to the keys under the individual genera.

The character of the spores is considered to be fundamental in classifying these fungi, with the structure of the context and other anatomical features also of great importance. Of the 10 genera, 4 have smooth, white spores; echinulate or tuberculate, white spores are characteristic of 3 other genera. Brown, tuberculate spores occur in 2 genera, and coral-pink, tuberculate spores in 1 genus. The stipe may be distinct from the pileus and central or lateral or may grade into it. The context may be fleshy or tough, or even woody when dry. The teeth may be low truncate ridges or pegs or short or long and pointed and awl-shaped. They may vary from 1 to 2 mm. to over 3 cm. in length. The color of the pileus may vary from white to buff, flesh color, vinaceous-brown, or smoky. It may be smooth or hirsute or scaly and may vary from 1 cm. to 20 cm. in diameter. Some of the fleshy species are edible and highly prized by connoisseurs.

The generic names and distinctions are mainly in accordance with Coker's earlier work on this group. They do not agree for a number of genera with the publications by L. W. Miller in 1933. The generic name *Hydnum*, as used by Coker, is called *Dentinum* by Miller, while Coker's *Sarcodon* is the *Hydnum* of Miller.

ERNST A. BESSEY

FLORA OF THE BRITISH ISLES.

By A. R. Clapham, T. G. Tutin, and E. F. Warburg. Cambridge University Press, London and New York. $9.50. liii + 1591 pp.; ill. 1952.

Flora of the British Isles is an entirely new manual of the vascular plants. Although its authors state in their Preface that they regard their work for the most part as a new compilation of existing material, their work as a whole can be regarded as fresh and unique. They appear to have made full use of up-to-date revisions wherever such were available, and they have secured the assistance of specialists in dealing with difficult families and genera.

The contents of the book are as follows: a Foreword by Prof. A. G. Tansley, Preface, Acknowledgments, a synoptic arrangement of orders and families in which are brief descriptions of the orders, an artificial key to the families, a table of signs and abbreviations, the manual itself, a selected bibliography, a list of the families showing which of the authors was responsible for each, some notes on the nature of the life form classification used, a glossary of terms (partially illustrated), and an index to common and scientific names. The book is printed in small octavo size, and in easily readable type. Within the manual itself there are dichotomous keys to the genera and to the species. Descriptions of species are brief but clear, and the authors state that they have with few exceptions been newly prepared from living material or from herbarium specimens. Only enough synonomy is given to make the book referable to other standard reference texts. With each species description, the chromosome number is given wherever it is known; and there are standard initials to indicate the life form classification according to the system of Raunkiaer. Information is also given on flowering and fruiting times, and on mechanisms of pollination and seed dispersal.

The book is only partially illustrated, with 79 text figures. These figures are used primarily to describe diagnostic characters, and do not illustrate whole plants. The authors say that a volume of illustrations is in preparation. Throughout the text, references are made to illustrations in readily accessible existing floras.

The flora includes both native and introduced species, each suitably indicated in the text. Ecological and geographic information includes brief notes on habitat, distribution in the British Isles, and a general résumé of distribution outside the British Isles. Measurements of plant parts are used freely, all of them given in the metric system. The authors have included vernacular names where the latter are available, but have made no attempt to create such names by fiat. In cases where invented names have come into some use, they have included them in quotation marks. Specific Latin names are consistently decapitalized throughout. The order of families is "in general similar to that adopted by Bentham and Hooker," though the authors say that they "have made a number of alterations to try to bring it more into line with modern ideas, and have always kept the doctrine of evolution in mind." They

have followed in general the nomenclature used in the *Check List of British Vascular Plants*, issued by the British Ecological Society in 1946.

The place and significance of the present volume in the long and scholarly history of British systematic botany is to be found in Prof. Tansley's Foreword, and in the first part of the authors' Preface. In the latter is a brief review of the history of the principal British floristic works that have appeared since the 17th century. Both here and in the Foreword, it is made clear that developments during the last fifty years, particularly in the fields of ecology and genetics, have greatly changed many of the old viewpoints from which the classically designed floras were written. This new book appears to have grown out of the necessity for bringing new viewpoints to bear in a manual that can be used for teaching or for the general identification of plants.

H. M. RAUP

ILLUSTRATED FLORA OF THE PACIFIC STATES. *In 4 volumes. Vol. III: Geraniums to Figworts (Geraniaceae to Scrophulariaceae).*

By Leroy Abrams. Stanford University Press, Stanford, California. $17.50. viii + 866 pp.; ill. 1951.

With the publication of Volume 3, the well-known *Illustrated Flora of the Pacific States* is now three-fourths completed. Larger than either of its predecessors (Vol. 1, 1923; Vol. 2, 1944), the present volume includes contributions by 14 specialists, who prepared the text for certain genera or families, or both. For instance, the late Francis W. Pennell wrote the text on the Scrophulariaceae (pp. 686–850) except that of the genera *Orthocarpus* (pp. 810–819) and *Penstemon* (pp. 733–770). The treatment of these genera is the work of D. D. Keck, who recognizes 91 species of *Penstemon* and various infraspecific entities for the area, and gives all known chromosome numbers in the descriptions. In the preparation of this volume the author received a great deal of assistance from Roxana S. Ferris, who contributed part of the text, selected material for the illustrations, and did the editorial work. The 1980 drawings, largely originals by Jeanne Russell Janish and other artists, and arranged in groups on full-page plates, add materially to the usefulness of this *Flora*. Subspecific entities with literature references, cultivated species, and other pertinent information are given in small print. An Appendix brings the treatment of the genus *Viola* in line with published accounts by Milo S. Baker and Jens Clausen. An Index to Genera and Families concludes the volume. It is to be hoped that the fourth and last volume can now be published in the near future.

THEODOR JUST

A MANUAL OF THE FLOWERING PLANTS OF CALIFORNIA.

By Willis Linn Jepson. University of California Press, Berkeley and Los Angeles. $5.00. 1238 pp.; ill. 1951.

Republication by offset of this well known *Manual* 25 years after its original publication attests its scientific soundness and continued usefulness to students and others interested in the rich flora of California. In fact, it is still the only book in which the flora of the entire state is treated, as other available works are either larger in scope, and therefore unfinished, or are limited to certain groups of plants or to smaller areas. During the intervening years many genera or groups of California species have been studied monographically or experimentally, and intensive collecting has yielded many additional distributional data. Yet the *Manual* in its original form stands as a remarkable document of the attainments of its author, until his opus maximum (and ultimum), *A Flora of California*, is completed.

THEODOR JUST

FERNS OF GEORGIA.

By Rogers McVaugh and Joseph H. Pyron; sponsored by The Garden Club of Georgia. The University of Georgia Press, Athens. $5.00. xviii + 195 pp.; ill. 1951.

The practice of state-wide floral surveys is one of long standing, and the present volume, which includes the fern allies as well as the ferns, provides distributional information on an area heretofore inadequately covered. Not all portions of the state of Georgia were surveyed, but the coverage in general is good, with each species described as to morphology, habitat, and range (in Georgia specifically and elsewhere generally), and with accompanying local distributional maps and definitive line drawings. Workable keys for both genera and species have been included. The botanist, however, would be fearful of exposing this attractive book to the rigors of field work.

C. P. SWANSON

ECONOMIC BOTANY

GENERALITÀ E MALATTIE CRITTOGAMICHE: *Part I. Patologia Generale e Fitoiatria. Patologia e Terapia Vegetale, Volume 1.*

By T. Ferraris; revised by R. Ciferri and E. Baldacci. Ulrico Hoepli, Milan. L. 2200.—(paper). xx + 707 pp. + 2 pl.; text ill. 1948.

This is a good modern book, in Italian, of 707 pages on the nature and control of plant diseases caused by

parasites. It is divided into 10 logically arranged chapters, which in turn are subdivided into sections, with pertinent literature citations at the end of each chapter. There are 111 figures, mostly line drawings, charts, with a few photographs, and 2 colored plates.

Chapter 1 deals with the scope of plant pathology, basic concepts regarding health and disease, the classification of diseases, kinds of pathogens, and the special fields of plant pathology. Then follow chapters on the classification of plant parasites; their biology and dissemination; pathogenesis, immunity, and resistance; pathological effects of pathogens; physiologic specialization, heterothallism, and variation in plant pathogens; symptomatology, diagnosis, and methods of investigation; epiphytology and economic importance of diseases; general principles of disease control; and specific control measures. The book is therefore a comprehensive treatise on the principles of plant pathology, based on well-selected facts which are skilfully used in developing concepts. Perspective and balance are good. Theory is subordinated to facts and principles; but the book is valuable for the facts alone, even though it is not a handbook of plant diseases. Almost half the book is devoted to principles and details of control measures, which substantially enhance its practical value.

The book is pleasant and profitable reading, both informative and stimulating. It makes an excellent textbook for advanced students and a valuable reference for plant scientists generally, but especially for those in the various fields of crop-plant production.

The typography is good, and the whole book is so good as to deserve better paper and binding. It should have a permanent place in the documentary record of the evolution of the science of basic and applied plant pathology.

E. C. Stakman

Elements of Plant Protection.

By Louis L. Pyenson; with line drawings by Emily B. Steffens. John Wiley & Sons, New York and Chapman & Hall, London. $4.96. x + 538 pp. + folding chart; ill. 1951.

Because the intensification of agriculture has resulted in creasing the severity of damage to plant growth by insects, bacteria, fungi, viruses, and weeds, it is timely to have under one cover a treatment embracing the various disciplines involved in plant protection. In 9 entomological chapters are considered the structure, life history, and classification of insect pests of cultivated plants, as well as their control by means of stomach poisons, contact insecticides, and newly developed synthetic materials. Three chapters are devoted to the control of other invertebrates, birds, and rodents. Another section of 6 chapters outlines the nature of bacteria, fungi, viruses, and plant diseases due to physiological disorders, states the general principles involved in control, and gives specific recommendations for control. The seriousness of weeds in agricultural practice may be inferred from the amount of space (7 chapters) devoted to them and to their control by various types of herbicides. A concluding section of 3 chapters considers equipment for the application of sprays and dusts for the control of diseases and pests.

The modest price of this volume was made possible by photo-offset reproduction. The numerous text figures and reduction of technical terms to a minimum result in clarity in the presentation.

F. T. Wolf

Insect Resistance in Crop Plants.

By Reginald H. Painter. The Macmillan Company, New York. $9.50; 7.25 (coll. ed.). xii + 520 pp.; ill. 1951.

The development of DDT and its equally spectacular successors tends to obscure the fact that, quite aside from insecticides, there are at least two other extremely important techniques for controlling insects. One of these is biological control by means of parasites and pathogens; the other, the subject of this book, is the use of resistant varieties of plants. Probably because the subject of insect resistance in crop plants straddles two disciplines of plant breeding and economic entomology, it has suffered the obscurity which characteristically is the fate of hybrid offspring. Despite this handicap the practical advantages which have accured as a result of the labors of those interested in resistance have been of inestimable value to agriculture. Yet our understanding of the basic mechanisms involved has been elementary, partly for want of a synthesis of factual material already available but scattered. Painter has supplied this synthesis in the present volume. An eminent worker in the field of plant resistance to insects himself, he has brought to this work a broad understanding and biological background which, together with his special acquaintance with the subject, make his volume authoritative, complete, and accurate. The subject matter falls into three parts. The first 3 chapters treat of the mechanisms of resistance and the factors that affect the expression or permanence of resistance; the next 5 chapters discuss in detail resistance in wheat, corn, cotton, sorghums, and potatoes, respectively; the final 2 chapters deal with methods and problems in breeding for resistance. A selected supplementary bibliography is appended. This book represents an outstanding contribution to agriculture and economic entomology, and will without a doubt become indispensable to workers and students in these areas.

V. G. Dethier

ADVANCES IN AGRONOMY. *Vols. I, II, and III.*

Edited by A. G. Norman. Academic Press, New New York. Vol. I: $8.50. xii + 439 pp.; ill. 1950. Vol. II: $8.50. xii + 407 pp.; ill. 1950. Vol. III: $8.80. x + 361 pp.; ill. 1951.

Advances in Agronomy has as its objective the survey and review of progress in agronomic research and practice. The articles are written by specialists and appear for the most part to be critical and comprehensive. The central theme of these volumes is that of soil-crop relationships, irrespective of the definition of what should and what should not appear under the title of agronomy. The topics have been selected, therefore, with consideration of what will be useful to agronomists. Among the 27 chapters in the three volumes, only 2 contributors live outside the North American continent. It is therefore, as the editor states, primarily a review of North American agronomy. For the many specialists in the field of agronomy, these *Advances* should provide sufficient information for them to keep abreast of newer developments somewhat removed from their immediate interests.

W. E. MCELROY

FIELD CROPS.

By Howard C. Rather. McGraw-Hill Book Company, New York and London. $5.50. ix + 454 pp.; text ill. 1951.

Written as a college textbook for elementary agronomy students, this book is admirably adapted for that purpose. It presents in 23 chapters a broad subject-matter area covering the major crops in the United States, their culture, geographic distribution, and the production principles most applicable.

The authors have presented the subject matter in a logical order and on an authoritative basis. The text begins with discussion on the significance and classification of field crops, follows with soil management and seedbed preparation, and concludes by examining the major crops. Thus alfalfa, red clover, corn, wheat, oats, sugar beets, cotton, potatoes, soybeans, and other crops are given individual attention. The principles for the production of hay, silage, and pasture management are given and discussed in appropriate chapters. The appendix covers weights and measures often used in agriculture.

Field Crops is an inviting book to read and study. The authors have succeeded in bringing a large amount of scientific data together, reducing it, and presenting the basic information in a clear, concise manner that makes for understanding and easy reading. Besides its usefulness as a textbook, *Field Crops* is valuable for anyone who wants a quick, concise, accurate background regarding the scope of field crop production in the United States.

GILBERT H. AHLGREN

THE LEMON FRUIT. *Its Composition, Physiology, and Products.*

By Elbert T. Bartholomew and Walton B. Sinclair. University of California Press, Berkeley and Los Angeles. $4.50. xi + 163 pp.; ill. 1951.

It is safe to say that most people take the lemon for granted, little realizing that it probably has a wider range of culinary, beverage, industrial, and medicinal uses than any other fruit.

To date, published investigations on the lemon fruit have been widely scattered in the literature. Consequently, anyone interested, whether he be producer, shipper or consumer, scientist or layman, will welcome this monograph which summarizes our present general and technical knowledge regarding this important fruit. The completeness of the summary is indicated by the fact that some 233 titles are listed in the bibliography. The work deals primarily with lemons grown in the United States, although some reference is made to foreign lemons and other citrus fruits as well.

The first chapter presents general information in regard to lemons under such headings as: origin and history, distribution and production, variety, fruit set and harvest, maturity, storage, structure, proportions of peel and pulp, age vs. size, growth-producing substances, and chemical changes.

The second chapter, entitled Composition and Physiology, is the most important, and occupies three-quarters of the book. It treats of such matters as specific gravity, color in peel, lipids, essential oil, hesperidin, bitter principles, moisture, effects of storage, respiration, starch, soluble solids, sugar, pH, organic acids, polysaccharides, pentosans, pectin, cellulose and hemicellulose, proteins, enzymes, vitamins, seeds, and inorganic constituents.

The final chapter, although only 8 pages in length, gives an adequate condensed résumé of the various products and their uses, some 75 in number. These are listed under whole fruit, peel, juice, and seeds, respectively. A subject index and an author index are supplied, in addition to the extensive bibliography.

ALBERT F. HILL

FORESTRY IN FARM MANAGEMENT. *2nd Edition.*

By R. H. Westveld and the late Ralph H. Peck; 2nd ed. revised by R. H. Westveld. John Wiley & Sons, New York; Chapman & Hall, London. $5.00. xii + 340 pp.; ill. 1951.

Teachers, foresters, and farmers will welcome this revised edition of a useful textbook, reference work, and manual of farm forestry. Emphasis, as in the original edition, is placed upon the farm forest as an integral part of the farm, and in consequence the idea is developed that the management of the farm woodlot must be coordinated with all other farm operations.

Up-to-date information on labor-saving devices, new wood preservative treatments, and cultural and protection methods are given. The book is carefully illustrated with numerous tables, line drawings, and half-tones.

SCOTT S. PAULEY

TABLE WINES. *The Technology of Their Production in California.*

By M. A. Amerine and M. A. Joslyn. University of California Press, Berkeley and Los Angeles. $4.50. xvi + 397 pp.; ill. 1951.

The making of fine wines is an art, and, to those who enjoy the products of that art, however diverse their tastes, a subject of some fascination. As an art, it reduces itself to no formalized procedure. Indeed, the quality of a particular vintage is elusive. It defies accurate description at the same time that it is a recognizable reality. On the other hand, the making of wines is an aspect of agricultural biochemistry, and as such it is subject to some degree of standardization and improvement through experimentation. It is with this aspect that the present book is concerned. It is prepared for the wine industry, and deals with such technicalities peculiar to that industry as equipment, fermentation, and aging, and with problems relating to the maintenance and improvement of uniformity and quality of product. It is not a highly technical book in the sense of dealing with basic problems of fermentation, or of the chemistry of aging. Rather, it is couched in language understandable to the vintner who knows his subject from a utilitarian point of view but who is unlikely to be thoroughly grounded in the science of chemistry. The authors have kept their audience in mind, they have discussed their topics in authoritative but not dogmatic terms, and they have produced a volume of more than general interest to the wine industry. It makes good reading even to the consumer.

C. P. SWANSON

THE CALIFORNIA WINE INDUSTRY 1830–1895. *A Study of the Formative Years.*

By Vincent P. Carosso. University of California Press, Berkeley and Los Angeles. $3.75. x + 241 pp. 1951.

Although the grape has been cultivated in California since early Mission days, cultivation for other than personal and religious use did not begin on an obviously commercial scale until Charles Kohler, a German musician, forsook Orpheus for Bacchus in 1853 to initiate what developed into one of the largest wine houses in America. Today California produces 90 per cent of the wine consumed in this country, largely because the climate is conducive to the successful cultivation of the European *Vitis vinifera*. Gradually, as the merits of the California wines were recognized and publicly acknowledged, the volume of foreign importations was reduced, although it must be noted that this change in taste was aided and abetted by protective tariffs and the destructiveness of the phylloxera in Europe. The early development of vineyards from Mission days, the pioneering drive for commercialization of the wine industry by Kohler and Colonel Haraszthy, a transplanted Hungarian, the unpredictable antics of the Legislature on the wine question, the effect of the depression and of Prohibition: all these make a fascinating story which has been well handled by Mr. Carosso. Now that the tariff on wines and liquors has been raised still higher, one almost wishes for the days of 1875 when good wines at 10 to 15 cents a gallon, and brandy at 37 to 40 cents, could not find a market.

C. P. SWANSON

SCIENCE AND THE GLASSHOUSE. *Second Edition.*

By William J. C. Lawrence. Oliver & Boyd, Edinburgh and London. 15s. xiv + 175 pp. + 4 pl.; text ill. 1950.

It is platitudinous to state that nowadays greenhouses are expensive to construct and to operate. Yet until the recent publication of this book very little was known about the most efficient design and orientation of the greenhouse or about what methods of culture in greenhouses will ensure optimum growth of plants. In many establishments and institutions methods are guided by guesswork, tradition, or hearsay, yet, as the author demonstrates, appropriate experiments properly conducted can point the way to much greater returns for the amount invested in costs of construction and operation of greenhouses.

The book is divided into 3 sections: The John Innes Composts; Methods of Cultivation; and Natural Illumination in Glasshouses. The first section outlines the ingredients, preparation, and uses of the celebrated John Innes composts. One cannot argue effectively against the merit of testing various mixtures or the adoption of those that give best results, but one might reasonably doubt that certain formulae can be universally superior when the main ingredient is as indefinable as "medium loam," which can differ so greatly in its physicochemical makeup in different agricultural regions of the world. Medium loams can differ sufficiently in native fertility that different fertilizer supplements will be required. Furthermore, the nature of the loam might also affect the proper sterilization procedure. Thus, aside from the hazard of release of excessive nitrogen, which is amply discussed, sterilization by heat can throw certain soils into very undesirable physical states.

In the section on methods of cultivation answers based on careful experimentation are given to such pertinent questions as the best size of seedlings for transplanting, best time of watering, effect of temperature of water, necessity of firming soil after transplanting, and the effect on plant growth of different combinations of treatments.

The third section presents data (chiefly in tables and appropriate figures) concerning the angles and direction of sunlight at different latitudes and times of year in relation to transmission of light through glass. Other aspects of light considered are its duration and intensity as governed by latitude and season, direct vs. diffused sunlight, and morning vs. afternoon light. Practical recommendations based on this information are given for the design, orientation, and location of greenhouses. Although much of the information is gleaned from observations of light in southern England, the principles derived would apply elsewhere. Plant growth in several experiments is shown to be closely correlated with the amount of light received. This book can be confidently recommended to anyone engaged in any aspect of greenhouse work.

CHARLES M. RICK

GENERAL AND SYSTEMATIC ZOOLOGY

MAN AND THE ANIMAL WORLD.

By Bernal R. Weimer. John Wiley & Sons, New York; Chapman & Hall, London. $5.00. x + 569 pp. + 16 pl.; text ill. 1951.

In this approach to the study of zoology, Man is the keynote, since he is the zoological specimen best known to students. Consequently the anatomy and physiology of the human being is described first, in order to provide an introduction to life principles and processes. About one-half of the text is devoted to these topics. The animal kingdom, ecology, and evolution follow, in that order. I for one am in sympathy with this method of presentation, which certainly provides a logical manner of introducing zoology to the beginning student. The only criticism of it concerns its emphasis on Man, but to anyone who has to teach large classes containing a mixture of students who are majoring in diversified fields and who are taking zoology as an elective or to fulfil a science requirement, the bias has many advantages. To maintain this interest, the relationship to man of the various animals, described in their respective phyla, is continually pointed out. The illustrations are adequate, consisting of line drawings (some original), photographs, and a few color plates. Two of the latter, of salamanders and of birds, are somewhat unnatural. The same picture is reproduced twice (pp. 29 , 291) for no apparent reason. The suggestion that birds navigate by visual landmarks is repeated twice in the same paragraph (p. 468) as though comprehending two separate theories. Other triviae could probably be dug out, but the general impression made on one is good. It is recommended that this book be examined by all college teachers of general zoology.

HENRI C. SEIBERT

A FIELD GUIDE TO THE SHELLS OF OUR ATLANTIC AND GULF COASTS. *Revised and Enlarged Edition.*

By Percy A. Morris. Houghton Mifflin Company, Boston. $3.75. xx + 236 pp. + 45 pl. 1951.

This is a new edition of a work already reviewed in these columns (*Q.R.B.*, 23: 249. 1948). Although it has now been expanded to include over 100 species not mentioned in the original edition, it is still a pocketsized manual, convenient for use on the beach. Six new plates have also been added, and in addition several of the less satisfactory plates in the first edition have been remade. Another very welcome improvement is the use of authority citations accompanied by dates in the case of genera. The nomenclature has been brought up to date in most instances but not in all. For example, *Lora* Gistel 1948 is used in preference to *Pleurotomoides* Brown 1831, though it is doubtful whether the species assigned to this genus really belong to it. Also, in writing of the Naticidae, the author states, ". . . they have been called *Lunatia* and *Neverita* . . . until the name *Polinices* was created for them." The implication here is that the last name is the youngest of the three, whereas actually it is older than the other two, which now take subgeneric rank beneath it. The family name Teredidae is bad Latin, and is usually given the correct form Teredinidae. Details of this sort do not detract very much from the value of a field guide, but attention should be called to them in reviews so that they may be corrected in future editions, which it is to be hoped will continue to appear from time to time.

The index is excellent; it contains nearly 1200 entries.

JOSHUA L. BAILY, JR.

THE DRAGONFLIES OF SOUTHERN AFRICA. *Transvaal Mus. Mem. No. 5.*

By E. C. G. Pinhey. The Transvaal Museum, Pretoria, with the assistance of a grant from the South African Council for Scientific and Industrial Research. £2 10s. 0d. xv + 335 pp.; ill. 1951.

This book is an illustrated descriptive catalog of the Odonata of South Africa, that area being defined approximately as the part of the Ethiopian region lying south of the Zambesi and Kunene Rivers. It is written by the entomologist of the Coryndon Museum of Nairobi, who has had materials from other African museums and from collectors, together with much aid and advice from the experienced British odonatologist,

Col. F. C. Fraser. It is a volume of 333 pages and 30 plates, with a few extras interpolated.

The author has gathered from scattered sources all that has been known of the dragonflies of South Africa, and has added a vast deal from his own study of them in field and laboratory. The text offers good descriptions of them and often most interesting field notes of observations on their habits. It provides also ample bibliographic references and synonymy. The illustrations mainly show color patterns and the details of genitalia. The pen drawings, though rather crude and somewhat inky, depict structural details well enough to be of great aid to the reader. In the first 2 plates of the volume bodily structures are shown and the parts labeled. Plate 2 illustrates wing venation. These two together serve as an introduction to the study of the systematic part which follows. At the end of the volume are grouped 10 good half-tone plates, the first 8 of which show whole figures of selected species.

Plate 2, showing wing venation, is worthy of mention for the confusion in vein nomenclature that it promotes. It departs from the names for veins that have been used for some fifty years (Comstock's) in nearly all papers that treat of the venation of insect wings, and that was based on sound morphology. It uses instead the lame Tillyard system that is based on "blue-sky" theory and is wholly inconsistent within itself. Using the same vein labels, the plate applies them to different veins and so increases the confusion. A table of equivalent systems of vein nomenclature occupies most of a page and is in 8 columns, all but 3 of which are devoted to the different systems proposed by Tillyard and Fraser at different times. In the labeling of this plate there is an egregious error. The true anal loop, which is always bordered in front by the anal vein, is not so labeled, but instead the label is placed on the accessory plantar loop. The photographs of Plates 19 and 20 are very good—and all the better because the venation has not been known for some of the genera shown.

The work as a whole is to be highly commended as a very useful and desirable extension of present knowledge of an interesting dragonfly fauna.

JAMES G. NEEDHAM

MOSQUITOES OF THE ETHIOPIAN REGION. *I. Larval Bionomics of Mosquitoes and Taxonomy of Culicine Larvae. Second Edition.*

By G. H. E. Hopkins; notes and addenda by P. F. Mattingly. British Museum, London. £2 5s. 0d. viii + 355 pp.; ill. 1952.

This edition is a revision of the volume published in 1936, and the extent of the new material included is indicated by the fact that the present edition is 105 pages longer than the first. This greater length is due primarily to the addition of 86 species to the 248 previously described. The organization is the same as that of the first edition, with brief opening discussions of ecology, external morphology, and techniques, followed by the main body of the book on taxonomy. The following genera are treated in the taxonomic section: *Toxorhynchites* (=*Megarhinus*), *Harpagomyia*, *Hodgesia*, *Uranotaenia*, *Aedomyia*, *Theobaldia*, *Orthopodomyia*, *Ficalbia*, *Taeniorhynchus*, *Aedes*, *Eretmapodites*, and *Culex*. There is a key to these genera by larval characters, and there are also keys to species within the larger genera. These keys, plus the descriptions, illustrated by 211 excellent figures, make this book indispensable to anyone concerned with the taxonomy of African culicine mosquitoes. It is also very useful for those who, although not directly concerned with the African mosquitoes, have a need for an adequate reference work in order to determine relationships between the species with which they are working and those from the Ethiopian region. Distributions and synonymies are not included, but were given in Part III of this series, published in 1941.

This excellent monograph on the mosquitoes of the Ethiopian Region, published in three parts, is an example of the splendid results that may be obtained through cooperative efforts on the part of competent workers.

LLOYD E. ROZEBOOM

HYMENOPTERA OF AMERICA NORTH OF MEXICO. *Synoptic Catalog. U. S. Dept. of Agric., Agric. Monogr. No. 2.*

Prepared cooperatively by specialists on the various groups of Hymenoptera under the direction of C. F. W. Muesebeck and Karl V. Krombein, and Henry K. Townes. United States Department of Agriculture, Washington, D. C. $4.00. 1420 pp. + 1 folding map. 1951.

Since 1887, when Cresson published his list of the Hymenoptera of North America, there has been no supplementary or revisionary faunal catalog of our forms. This, perhaps more than any other factor, has made entrance to the taxonomy and taxonomic literature of the Hymenoptera an almost insuperable task for the newcomer. The superb synoptic catalog now at hand is at once the sorely needed taxonomic and distributional list, as well as a compendium of hosts and prey (many records being entirely new ones), and a bibliography of published revisional papers, keys, and biologic studies through 1949.

The described species of North American Hymenoptera have been doubled and redoubled since Cresson's time, and the current volume lists probably more than 16,000 named species, subspecies, and varieties of the Hymenoptera. These are arranged systematically in all categories above specific rank, and alphabetically for categories of specific or lower rank. Citations of

genotypes for genera and subgenera are made along with the authority for such selections. For each genus and lower category very complete synonymies are given, and many of the reductions of names appear here for the first time. The known distribution is indicated for each species by state or province (Canada), or by faunal zone, and references are given to all (or most) published accounts of the biology of each form for which such exist.

As would be expected, a necessarily critical work of this type will, in addition to new synonymies, result in a fair number of changes in name. Some 74 new specific names appear, as well as 6 new subspecific or varietal names, 5 new generic and 2 new subgeneric names, 2 new tribal and 3 new subfamily designations, and 3 new family names. There has furthermore been a very considerable change of generic limits within the Hymenoptera in the last two decades, and consequently not a few of the binomials for even our familiar forms will seem strange to those who have relied on the more recent local catalogs for their systematic arrangements. Comparison, say, of the names of Hymenoptera in the *New York. State List of Insects* (Cornell Univ. Agric Exp. Sta., Memoir 101, 1926) with their current designations in this new synoptic catalog, will show how far-reaching and significant the changes in taxonomy have been. And, let it be added, they seem all for the better.

The catalog was first planned in 1946, and some 21 other specialists joined with Muesebeck, Krombein, and Townes to bring it to completion. The magnitude of the effort that has gone into this catalog is astounding, the cooperation exemplary, and the result magnificent. Let us hope that its energetic authors plan periodic supplements to the catalog as they are needed, for much new work on American Hymenoptera may now be expected.

KENNETH W. COOPER

A CATALOGUE OF THE AMERICAN HESPERIIDAE *Indicating the classification and nomenclature adopted in the British Museum (Natural History). Part I: Introduction and Group A—Pyrrhopyginae.*

By Brigadier W. H. Evans. The British Museum, London. 15s. x + 91 pp. + 9 pl. 1951.

This is a purely taxonomic work, being really a cross between a catalog and an enormously expanded key. It is of the greatest taxonomic importance, since it brings together for the first time a great deal of information previously scattered throughout the literature. It is fitting that this should be based on the unequalled British Museum collection, and be done by Brigadier Evans, one of the greatest world authorities on the Hesperioidea. Line drawings illustrate the diagnostic characters of the male genitalia of nearly all of the 147 species and of many of the subspecies. Although no bibliographic citations are given a lack which will prove a grave handicap to many users) the dates of publication of the names are cited. A similar coverage of the remaining, far larger, subfamilies of the Hesperiidae is projected.

ALEXANDER B. KLOTS

A REVISION OF THE GENUS ANNAPHILA GROTE (LEPIDOPTERA, PHALAENIDAE). *Bull. Amer. Mus. nat. Hist., Vol. 98, Art. 3.*

By Frederick H. Rindge and Claude I. Smith. American Museum of Natural History, New York. $1.00 (paper). Pp. 191–256; ill. 1952.

This is an excellent example of modern taxonomy, through and detailed, and making use of all known possible characters from the seasonal and geographic distributions to the male and female genitalia. Synopses are given of what is known about the phenology, habits, and life histories. The genus is limited to western North America. Nineteen species and 2 additional subspecies are recognized. A new subgenus, *Proannaphila*, type species *A. danistica* Grote, is proposed. Six of the species and 2 subspecies are described as new. The genitalia of all known males and females are figured. Illustrations of the adults would have added materially to the value of the revision; but references are given to colored figures of nearly all of these in other publications.

ALEXANDER B. KLOTS

A REVISION OF THE NORTH AMERICAN AND EUROPEAN STAPHYLINID BEETLES OF THE SUBTRIBE GYROPHAENAE (ALEOCHARINAE, BOLITOCHARINI). *Fieldiana: Zool. Vol. 32, No.10. December 21, 1951.*

By Charles H. Seevers. Chicago Natural History Museum, Chicago. $1.25 (paper). Pp. 657–762; ill. 1951.

The Aleocharinae comprise a large number of usually very small species of staphylinid beetles. Their systematics in general is in a very confused state. The present monograph attempts to bring order into the Palaeartic species of the subtribe Gyrophaenae, which can be found in great abundance on fresh mushrooms, on which adults and larvae feed. The paper contains descriptions of 98 species, 72 from North America (50 from East of the mountains, 19 from the West, 3 from both), 24 from Europe, 2 common. There are keys, biological and ecological notes, and hints for collecting and preparing specimens. The male genitalia, which provide the most important diagnostic criterion, are figured. The synonymy is given proper consideration, and in particular the validity of Casey's species clarified. The monograph should be a valuable help to those interested in this group of beetles.

G. H. DIEKE

REVISION OF THE GENUS CALENDRA (FORMERLY SPHENOPHORUS) IN THE UNITED STATES AND MEXICO (COLEOPTERA, CURCULIONIDAE). *Bull. Amer. Mus. nat. Hist., Vol. 98, Art. 2.*

By Patricia Vaurie. American Museum of Natural History, New York. $2.00 (paper). Pp. 33–186; ill. 1951.

This monograph deals with the so-called billbugs, a genus chiefly found in North America. The genus is easily recognized. Some of the species are destructive to grasses and cereals. No general account of this genus has appeared since 1876, athough more than 50 new species have been described since then. The paper describes 71 valid species, 50 from the United States and Canada, 7 from Mexico, and 14 common to both. There are keys, drawings of the chief distinguishing characteristics including the male genitalia, distribution maps, biological notes, etc., and a very careful account of the types, most of which were examined by the author.

The monograph will be of great help to all interested in this genus.

G. H. DIEKE

AMPHISBAENA FULIGINOSA. *Contributions to the knowledge of the Brasilian lizards of the family Amphisbaenidae Gray, 1825. 6. On the geographical distribution and differentiation of Amphisbaena fuliginosa Linné. Bull. Mus. comp. Zool., Harvard Coll., Vol. 106, No. 1.*

By P. E. Vanzolini. Museum of Comparative Zoology, Harvard College, Cambridge, Mass. $1.75 (paper). 67 pp. + 2 pl.; text ill. 1951.

Of all lizards, perhaps the strange legless, burrowing, annulated amphisbaenians are the most intriguing. This paper deals with the variation in 7 characters, among them particularly in number of annuli, in the South American species *A. fuliginosa*. The author makes out a good case for division of the species into 5 subspecies which have differentiated since Pleistocene times from the species center in the Amazon valley. The paper should be of considerable interest to students of evolution, as well as to herpetologists.

GRØNLANDS FUGLE. *The Birds of Greenland. Part III. By Finn Salomonsen; plates by Gitz-Johansen. Ejnar Munksgaard, Kobenhavn.* Vols I–III, $42.00; £14 15s. 0d. Pp. 349–608 + special map of Greenland; ill. 1951.

We now have the third and last installment of the *Birds of Greenland* which covers the Auks; Guillemots and Puffins; the Birds of Prey; and the Passerine Birds, only a limited number of which permanently inhabit this great northern island. As before, Finn Salomonsen, the author, has surveyed them admirably and deserves high praise for his painstaking and highly informative treatment of the subject. An excellent map of Greenland, a systematic list of species with reference to all casual visitors and stragglers, an exhaustive bibliography, and an index complete this work of 607 pages.

As to the illustrations by Gitz-Johansen, they consist of 16 colored plates, which bring the total in the 3 volumes to 52 and a number of small cuts. The reproduction process is excellent, but the new plates are not such as to reverse our previous opinion that the artist seems to have little understanding of the shapes, actions, and attitudes of the birds represented.

The present book will long remain the standard work on the birds of Greenland, a particularly interesting country where both nearctic as well as palearctic forms are found.

J. DELACOUR

AUDUBON WATER BIRD GUIDE. *Water, Game and Large Land Birds. Eastern and Central North America from Southern Texas to Central Greenland.*

By Richard H. Pough; color illustrations by Don Eckelberry; line drawings by Earl L. Poole. Sponsored by the National Audubon Society. Doubleday & Company, Garden City. $3.50. xxviii + 352 pp. + 48 pl.; text ill. 1951.

The present guide is a companion volume to the one published earlier on the land birds of eastern and central North America from south Texas to central Greenland. The same geographical area is included in this volume. Although the title indicates a limitation to water birds, the text does include such non-aquatic groups as the hawks, grouse, and pigeons. The reason for this lies in the fact that the species have been arranged according to taxonomic sequence, and the division line for the 2 volumes is arbitrarily taken between the pigeons and the parrots.

The treatment of each species includes a brief descriptive paragraph for purposes of identification, followed by sections on habits, voice, nests (and eggs), and range. The common name (also the British common name, if different from ours), the scientific name, the length, weight, and wingspread of the bird, its longevity, length of incubation, and other bits of information are incorporated in the appropriate places. A quick survey readily reveals that much of this information is still lacking. In the center of the book are 48 color plates that depict each species considered within the scope of the book. Variations in plumage, whether because of sex, season, or age, are shown.

The jacket advertises this manual as the best identification guide yet devised for the layman. It is unfortunate that the publisher has made such a statement, as it will inevitably invite comparison with Peterson's *Field Guide*. It should perhaps be emphasized that the two Audubon guides are not competitors with the

Peterson books at all, but are actually supplementary. The Audubon Guides provide a résumé of the natural history of the species rather than a means for their identification in the field, although obviously the numerous illustrations will be helpful in the latter function. These illustrations, both those in color and those in black and white, are good, although the color plates are frequently somewhat confusingly crowded. The standards of bird portrayal in bird books are steadily becoming higher, and the illustrations in this Guide do not lower that excellence. The flyleaves show the biomes of North America and an interesting map of the Atlantic which has on it the flyways, the average surface temperatures (annual?) of the water, and the relative bird abundance for each 10° quadrant of latitude and longitude.

HENRI C. SEIBERT

THE BIRDS OF MICHIGAN. *Misc. Pub., Mus. Zool., Univ. Mich., No. 75.*

By Norman A. Wood. University of Michigan Press, Ann Arbor. $4.00 (paper). 559 pp. + 16 pl. 1951.

Previous to the appearance of the present work the last general account of Michigan birds was Barrows' *Michigan Bird Life*, published in 1912. There are now 334 forms (309 species) of birds known to occur or to have occurred within the borders of the state. A detailed account of the status of each form is provided under the headings of Spring, Summer, Fall, and Winter. For species which occur in both the Upper and Lower Peninsula, the records for each season are divided under these subheadings. Records are arranged in the following sequence: spring and summer records, from the southern edge of the state northward; fall records, from the northern edge southwards. Such a compendium is obviously the result of observations by many workers, duly acknowledged herein, but the late author was the guiding light and most active contributor. Fortunately, others were willing to complete his work after his death. Although consisting of 559 pages, not one inch has been wasted on superfluous material. In contrast to many state publications, which attempt to be not only a distributional record but also a guide to identification, a reference on life history, and at the same time still to have a wide popular appeal, the present work is wisely concerned solely with distribution. The data are therefore presented in satisfying detail. There is a complete bibliography, an index, a map of the state showing the counties, and several bird photographs.

HENRI C. SEIBERT

ANNOTATED LIST OF BIRDS OF BARRO COLORADO ISLAND, PANAMA CANAL ZONE. *Smithsonian Misc. Coll., Vol. 117, No. 5. Pub. 4058.*

By Eugene Eisenmann. The Smithsonian Institution, Washington. 45 cents (paper). 62 pp. 1952.

Lying in Gatun Lake of the Panama Canal Zone, Barro Colorado has become well known as a biological research center. Its bird life was investigated by several competent workers, but continuous additional observations have added to the local list. Some 306 species are now known to occur here. These have been listed in the present publication, together with pertinent information on the nesting, song, habitat, and general status on the island of each. An ecological description of the area and a full bibliography help make this list a useful reference work.

HENRI C. SEIBERT

HOW TO KNOW THE AMERICAN MAMMALS.

By Ivan T. Sanderson; with full line drawings by the author and full-color plates by Louis Agassiz Fuertes. Little, Brown & Company, Boston. $2.50. 164 pp. + 24 pl.; text ill. 1951.

The author, a well-known lecturer and explorer, writes from a wide background of experience of field and museum studies of our native mammals, and with a facility for reducing technical descriptions to readable form. The result is a compact, well-done field-book of a semipopular nature. The treatment has been to segment the animals into the carnivorous, hoofed, leaping, gnawing, and aquatic mammals, with additional chapters on the ancient species such as the bats, insect-eaters, toothless and pouched forms, and one on the more recent mammals which have been associated with the coming of man. Line drawings by the author, colored plates by Fuertes, and ten pages of animal tracks, give the text an added attraction.

A FIELD GUIDE TO THE MAMMALS *Giving Marks of all Species Found North of the Mexican Boundary. The Peterson Field Guide Series, Sponsored by National Wildlife Federation and National Audubon Society.*

Text and Maps by William Henry Burt; Illustrations by Richard Philip Grossenheider. Houghton Mifflin Company, Boston. $3.75. xxi + 200 pp. + 32 pl.; text ill. 1952.

The editorial preface to the *Field Guide to the Mammals* quite rightly remarks that Ernest Thompson Seton would have approved this book. He would have approved not only its emphasis on the field marks by which the species may most readily be distinguished in life, but more particularly its illustration of tracks and other habits. It is one of the major calamities to American natural history that Doubleday Doran & Company so much underestimated the demand for Seton's *Lives of Game Animals* (in the popular edition of 1929) that this eight-volume work was immediately

exhausted. The *Lives* should be reprinted—it would form the essential library supplement to the Burt and Grossenheider *Field Guide*.

At the level of a field identification manual, the new *Field Guide* is in every way a most competent work, as would be expected from the teaming up of one of the leading mammalogists of the country with one of our best animal artists. The emphasis on species and de-emphasis of subspecies is logical and appropriate for works on systematic zoology at the popular level. I should nevertheless have liked the type localities for the subspecies entered on the maps (following Seton's example), as an aid to those amateurs and beginners who wish to carry their studies to a more advanced level. Otherwise the maps, like the rest of the black and white illustration, are unexceptionable. The suggestions for further reading, geographically assorted, are well chosen, and the student who wishes to read further is wisely advised to turn at once to the *Journal of Mammalogy* and to the *Journal of Wildlife Management*. I miss reference to the invaluable Seton.

As the editor of the Field Guide Series remarks, Grossenheider has a particular talent for painting the smaller mammals, which is obviously based on sympathetic observation. The comparison of Grossenheider with Albrecht Dürer, however, seems singularly inept. A reference to Dürer's pregnant aphorism as to where art lies might have been more appropriate—"Die Kunst steckt in der Natur drin, wer sie heraus kann holen, der hat sie."

I find other minor disagreements with the editor and publisher rather than with author and artist. The artistic effect of the superb colored figures of most of the mammals is unnecessarily marred by the black lines that are intended to point out the key character; yet no one needs to have the tail or the ear or the tip of the nose or the quality of whiteness marked with an arrow. The common names of mammals are capitalized in the text, whereas this is a long outmoded form, still appropriate perhaps in juvenilia, but not in a work at the level of the *Field Guide*.

KARL P. SCHMIDT

AMERICAN WEASELS. *Univ. Kans. Pub., Mus. nat. Hist., Vol. 4. December 27, 1951.*

By E. Raymond Hall. University of Kansas, Lawrence. Free upon request. Pp. 1–466 + 41 pl.; text ill. 1951.

General acclaim should greet the assumption by some of our larger museums of the taxonomic "Cloak of Elijah" that for some years has been slipping from the shoulders of the United States Fish and Wildlife Service (formerly the Biological Survey). The University of Kansas Museum of Natural History is one of the most active pretenders to the more-or-less vacated throne of the North American Fauna Series. *American Weasels*, by E. Raymond Hall, is their most recent contribution in the field of mammalogy.

Systematically, Hall has produced order out of chaos by reducing the weasels to only 4 full species, the least, short-tailed, and long-tailed weasels of wide recognition, and the rare *Mustela africana* of South America. Much of the space in the book is devoted to detailed taxonomic comparisons and distributional data, presented in the familiar form of the North American Fauna Series. Much additional information on the paleontological history, food habits, molts, color changes, and reproductive habits is also included. The phenomenon of delayed implantation receives only brief attention, but full literature citations are given. There is an excellent frontispiece in color showing variations of the face and neck in the long-tailed weasel. While hardly entertaining reading, this volume is an important addition to current taxonomic literature, especially in its combination of classic systematics with the modern evolutionary concept.

BRYAN P. GLASS

THE RODENTS OF AUSTRALIA AND NEW GUINEA. *Results of the Archbold Expeditions. No. 65. Bull. Amer. Mus. nat. Hist., Vol. 97, Art. 4.*

By G. H. H. Tate. American Museum of Natural History, New York. $5.00 (paper). Pp. 187–430; ill. 1951.

MAMMALS OF CAPE YORK PENINSULA. *With Notes on the Occurrence of Rain Forest in Queensland. Results of the Archbold Expeditions. No. 66. Bull. Amer. Mus. nat. Hist., Vol. 98, Art. 7.*

By G. H. H. Tate. American Museum of Natural History, New York. 75 cents (paper). iv + pp. 567–616. 1952.

A discussion of the comparative morphology and evolution of the rodents of New Guinea and Australia, and a review of the geologic history of the region serves as an introduction to this catalogue of its rodent fauna. In all, 32 genera are recorded, including 345 named forms, both species and subspecies. Of these, 5 full species and 7 subspecies are new. Most attention is paid to description. Little information is given regarding distribution except the notation of collection stations, and in some cases the elevations at which certain forms might be expected. The small number of maps (only 4), and the paucity of data on ranges makes it plain that in spite of the unrivalled nature of the Archbold Collections, a full understanding of the fauna of this region is still unattained. The present volume will be a valuable check-list for future workers.

In the *Results of the Archbold Expeditions No. 66*, the author's opportunity of roughly surveying the entire Cape York area has resulted in a report not only upon its mammalian fauna, but also of their habitat preferences. The first part of the book deals with the

distribution of rain forest, comparing it with the adjoining open forest. There follows a list of mammal species grouped according to habitat, e.g., derived from Papuan rain forest, indigenous to Queensland rain forests, preferring rocky hillsides, etc. The treatment by species is similar to that of the preceding publication, but the author's personal familiarity with so many of the animals as well as with the regional geography make for greater interest. The sections on the spiny anteater and the dingo are especially recommended.

BRYAN P. GLASS

ECONOMIC ZOOLOGY

FICHES D'IDENTIFICATION DU ZOOPLANCTON, *No. 18–29. Published under the direction of M. le Dr. P. Jespersen and M. F. S. Russell. Conseil Permanent International pour l'Exploration de la Mer, Charlottenlund Slot - Danemark; [Andr. Fred. Høst & Sons, Copenhagen]*. Kr. 10.00 (paper). 52 pp.; ill. 1950.

Keys No. 18 to 27, by H. Nouvel, are for the mystids occurring between 80°N and Cape Finisterre and between 20°W and 80°E. Keys No. 28 and 29, by F. S. Russell, are for hydromedusae, families Tubulariidae (completed), Margelopsidae, and Corynidae, for the same general region.

JOEL HEDGPETH

MARINE PRODUCTS OF COMMERCE. *Their Acquisition, Handling, Biological Aspects and the Science and Technology of their Preparation and Preservation. Second Edition, Revised and Enlarged.*

By Donald K. Tressler and James McW. Lemon. Reinhold Publishing Corporation, New York. $18.00. xiii + 782 pp. + 1 pl.; text ill. 1951.

A new edition of this valuable reference work has long been in demand, although it may turn out that the demand will taper off in view of the very high price of this edition. According to the introductory statement, this book has been almost entirely rewritten. Certainly a great amount of material has been added, and some of the sections have been brought up to date. However, a great many of the mistakes of the earlier edition have been repeated verbatim, and a few new ones have been added. Most of these mistakes may appear to be of little importance to fisheries technicians, but they are the sort which irritate zoologists and indicate careless editorial work. On p. 610, for example, there is a list of 21 species of crabs, in which there are 6 mistakes (not counting others indicated by ditto marks), which were mistakes in the first edition in 1923. Most of the species in this list are of negligible commercial importance. There are several typographical errors in the shrimp section, and the specific name *duorarum* is consistently misspelled *duoarum*. It would appear, from statements on pp. 125 and 591, that the editors do not know the proper meanings of "species" and "genus." The impression is given that there is only 1 species of *Donax*, occurring both in Florida and Southern California (p. 678). The serious error of the first edition in failing to distinguish clearly between the California mussel and *Mytilus edulis* and thereafter stating that "mussels are best from December to July; they therefore may be used as a substitute for oysters during the early summer" has been repeated. Let us hope no one dies from mussel poisoning after consulting this book.

A number of obvious typographical errors on p. 612 led to a check of the table on that page, which gives the composition of Japanese and dungeness crab meats. It turns out that this table is a meaningless and uncritical combination of 3 tables, the column for Japanese crab being for canned meat, and that for dungeness representing fresh meat values except for the ash figure, which is for canned meat. While a number of other tables were checked without finding similar mistakes, many short tables are given without acknowledgment of the source. Some of the larger tables appear to be photographic copies, but again for too many of them the precise source is not given. At so high a price, the prospective buyer deserves better from the publisher. It is also unfair to those who have been listed in the Introduction as having read sections of the book and provided suggestions, since the implication that they read certain parts of the book is known to be untrue in at least one case.

Some of the signed chapters, especially those on agar, whaling, and fish smoking, are excellent, and the chapter on pearls by the man from Tiffany's displays the expected disdain for Japanese cultured pearls. In this section, considerable space has been devoted to a discussion of the imitation pearl industry. It would have been worth-while to consider or at least to mention the competition of plastics in the chapters on pearl buttons and sponges.

JOEL W. HEDGPETH

CONGRÈS INTERNATIONAL D'ÉTUDE SUR LE ROLE DU POISSON DANS L'ALIMENTATION.

Symposium, Paris, October 26, 27, 28, 1951. Institut Océanographique, Paris. 1000 fr. 550 pp.; text ill. 1951.

A surprising amount of material, constituting in effect a summary of the knowledge of the nutritive value of fish, and of fisheries technology and processing in the countries of western Europe, is presented in this Congress Report. There are 34 separate articles, including in addition to the subject matter indicated by the title, discussions of marketing and advertising problems and of allergies to fisheries products and their

treatment. There are many tables, and the bibliographies of several of the papers run to more than 100 entries. The data presented are in most cases more complete and up to date than in the revised edition of *Marine Products of Commerce*, by Tressler and Lemon (q. v.). The term "fish" is construed in the broadest sense, so that shellfish and whales also receive consideration.

JOEL W. HEDGPETH

PURSE SEINES AND OTHER ROUNDHAUL NETS IN CALIFORNIA. *State of Calif. Dept. Fish, Game, Bur. Mar. Fish., Fish Bull. No. 81.*

By W. L. Scofield. California Department of Fish and Game, San Pedro. Free upon request (paper). 87 pp.; ill. 1951.

A COMPARISON OF THE POPULATIONS OF YELLOWFIN TUNA, NEOTHUNNUS MACROPTERUS, FROM THE EASTERN AND CENTRAL PACIFIC. *State Calif. Dept. Fish Game, Bur. Mar. Fish., Fish Bull. No. 82.*

By H. C. Godsil and E. C. Greenhood. California Department of Fish and Game, San Pedro. Free upon request (paper). 36 pp.; ill. 1951.

AGE COMPOSITION OF THE SOUTHERN CALIFORNIA CATCH OF PACIFIC MACKEREL 1939–40 THROUGH 1950–51. *State Calif. Dept. Fish Game, Bur. Mar. Fish., Fish Bull. No. 83.*

By John E. Fitch. California Department of Fish and Game, San Pedro. Free upon request (paper). 77 pp. + 1 pl.; text ill. 1951.

COMMERCIAL AND SPORT FISHES OF THE MISSISSIPPI RIVER *Between Caruthersville, Missouri, and Dubuque, Iowa. State Ill. Dept. Regist. Educ., nat. Hist. Surv. Div. Bull., Vol. 25, Art. 5. September, 1951.*

By Paul C. Barnickol and William C. Starrett. Illinois Department of Registration and Education, Urbana. Paper. iii + pp. 267–350 + 1 pl.; text ill. 1951.

FISHING WAYS AND WILES. *New and Enlarged Edition.*

By Major H. E. Morritt; Introduction by Lord Howard de Walden. Jonathan Cape, London. 10s. 6d. 192 pp.; ill. 1950.

This book was obviously written by a man of considerable experience in the ancient and honorable art of angling. Technically, it may be perused by novice and expert with benefit to both; and even the non-angler may come to understand that, in the words of the author, "Fishing is not a subject to be taught by precept but rather a way of life to be experienced and loved, indeed, a religion in which the veriest novice can, while he is learning, find excitement, peace, content and beauty."

SCOTT S. PAULEY

LEE WULFF'S NEW HANDBOOK OF FRESHWATER FISHING.

By Lee Wulff; illustrated by the author. J. B. Lippincott Company; Philadelphia, New York. $2.95. xiv + 242 pp.; ill. 1951.

This handbook offers much that should appeal to fishermen, particularly new ideas that could be applied to situations and equipment with which the reader has some, even if limited, experience. A wide range of topics is covered, including sections on the recently popular art of spinning. Readers should note that "eels" are not "one of the oldest forms of life still existing on our earth." A serious defect, in my opinion, is the omission of any chapter on the concepts and practices of modern conservation. The author could have done sportsmen a real service by telling them of the tremendous strides that are being made in this field, and notably about the increasing realization of the inadequacy of stocking programs, as opposed to those of habitat restoration.

JOHN CUSHING

APPROVED PRACTICES IN BEEF CATTLE PRODUCTION.

By Elwood M. Juergenson. Interstate, Danville, Ill. $1.85 (paper). 248 pp. + 1 pl.; text ill. 1951.

This book is written primarily for the vocational agricultural student and the professional beef producer. Emphasis is placed on the practical, day-to-day problems of the beef producer and on how to carry out accepted management practices. The topics discussed range from management of the breeding herd, care of the cow and calf, rations for all ages and types of beef cattle, and parasites and diseases, to the production of beef for the home locker. The outline method of presentation is effectively used, and the entire book is summarized in outline form at the end.

FREDERICK N. ANDREWS

HORSES.

Edited by Bryan Holme; introduction by Alleine E. Dodge. Studio Publications in Association with Thomas Y. Crowell Company, New York and London. $3.50. 98 pp.; ill. 1951.

This is a book of equine appreciation and, to a certain extent, history. As such, it consists largely of illustrations, some 130 or more, ranging from ancient statues, prints, and tapestries to the more recent photographs. The diversity of the illustrations, the beautiful format, and the high quality of reproduction will delight the horse lover, and earn a deserved place in his library. An introduction, concerned with the history of the horse in so far as it relates to man, provides a bit of literature for the equestrian who reads, and is brief enough to read standing up after a hard ride.

C. P. SWANSON

RAISING SMALL ANIMALS FOR PLEASURE AND PROFIT. *By Frank G. Ashbrook. D. Van Nostrand Company, Toronto, New York and London.* $4.00. viii + 260 pp.; ill. 1951.

There can be a lot of fun, and if rightly done, a fair amount of profit from animals raised in a limited area. Also, the variety of animals is such that there are some species which can be raised in almost any part of the country. The 4H clubs throughout the country have done much to stimulate an interest in the smaller farm animals, with the result that no only has the variety of meats for the table and market been increased, but the effect on the education and the responsibilities of the younger generation has been considerable. The undertaking of a small animal project, however, is one that requires some knowledge of the habits, diseases, food, and care of the particular species. This information the author provides, in language which is readily understandable. The book is a mine of sound advice, even to the preparation of some unusual recipes. Chapters on management, marketing, and storage follow extensive discussions of individual animal species, these being grouped into more or less coherent sections, such as small animals, poultry, game birds, fur bearers, and fish. A large number of references concludes the book, and these provide the reader with the sources of more detailed information on special topics.

ANIMAL GROWTH AND DEVELOPMENT

SOMATIC DEVELOPMENT OF ADOLESCENT BOYS. *A Study of the Growth of Boys during the Second Decade of Life.*

By Herbert Rowell Stolz and Lois Meek Stolz. The Macmillan Company, New York. $9.00. xxxiv + 557 pp.; ill. 1951.

The Drs. Stolz have taken upon themselves to make an extremely complete study of the growth changes that take place in boys between the ages of 10 and 20. Every measurement is recorded in numbers, and each boy in the study has been photographed at 6-month intervals, to illustrate the successive changes. There is no question that a youngster who is undergoing such profound somatic shifts has a special problem in assimulating this change. It is the authors' thesis that these changes come about in sequence, at an individual pace, rather than in direct ratio to actual age. If the individual child is to be properly understood, he must be identified in terms of his somatic development, rather than on the arbitrary index of his years. As an illustration of the interreaction of soma on psyche, the authors include one very detailed case history of one boy's personality changes from the prepuberal period through his eventual physical maturation.

From a psychiatric point of view, this book would be more significant had a more intensive investigation of the inner dynamics been possible. However, the authors have contributed a most thorough piece of research on the physical side of the adolescent's growth.

HELEN ARTHUR

CONFERENCE ON PROBLEMS OF AGING. *Transactions of the Thirteenth Conference, February 5–6, 1951, New York. Sponsored by the Josiah Macy, Jr. Foundation. Edited by Nathan W. Shock. Josiah Macy, Jr. Foundation, New York.* $4.00. 194 pp. + 1 pl.; text ill. 1951.

The 13th Conference on the Problems of Aging, like earlier conferences, was limited to a small number of special papers. In the first paper of the report, Endocrine Aspects of Aging, Earl T. Engle dealt chiefly with the functioning of the gonads in men and women. J. Murray Steele discussed Cardiovascular Aspects of Aging, and E. V. Cowdry treated Aging of the Integumentary System with principal reference to mice. In The Biology of Cell Division, W. Jacobson of the Strangeways Research Laboratory reviewed the evidence for nucleoprotein participation in the division of cells in tissue culture. In addition, Clark Tibbits summarized the activities of federal agencies in the field of gerontology, and Cowdry gave a preview of the Second International Congress on Gerontology, since held in St. Louis.

The *Transactions of the 13th Conference on Problems of Aging* differs from earlier volumes in the series only in being bound in cloth, with a consequent increase in price. The papers themselves are presented in an extremely brief and informal style, with the discussions, relevant and irrelevant, reproduced in full. Thus the book, though stimulating, is of limited value as a source of information. There are brief bibliographies, but no index.

FLORENCE MOOG

ANIMAL MORPHOLOGY

COMPARATIVE STUDIES ON THE JAWS OF MANDIBULATE ARTHROPODS. *Smithsonian Misc. Coll., Volume 116, Number 1. Publication 4018.*

By R. E. Snodgrass. Smithsonian Institution, Washington, D. C. (paper). 85 pp.; ill. 1950.

This impressive study of the comparative morphology of the jaws of the Crustacea, Chilopoda, Pauropoda, Symphyla and Diplopoda, Diplura, Collembola, Protura, Thysanura, and (very briefly) of the Pterygota unfortunately contains no summary or general discussion apart from the Introduction, and there is also no index apart from the taxonomic arrangement of the Table of Contents. Those who are interested in the evolutionary development of the arthropods will have to dig out the substance of these studies for themselves.

BIOLOGY OF DROSOPHILA.

Edited by M. Demerec. John Wiley & Sons, New York; Chapman & Hall, London. $10.00. x + 632 pp.; ill. 1950.

Among geneticists and other *Drosophila* workers the crying need for such a book as this has long been felt, and after it was announced as being in preparation the prolonged deferment of hope once aroused produced in many quarters a keen impatience. Now the book has already, in the months since its publication, made itself an indispensable reference work in those numerous laboratories the world over where the tiny fruit-fly is used in experimental work. The several contributions represent painstaking, scholarly care and critical evaluation of those aspects of the subject which have been covered; and not a little original work has gone into the reviews in order to check dubious or conflicting observations, to supplement them and sometimes to fill considerable gaps in present knowledge, and to correct erroneous theory and develop sounder views.

The only fair criticism of so enormously valuable a work might be directed against its omissions. In the first place, the very title of the book is a profound misnomer. This book is not at all a "biology" of *Drosophila*, in any comprehensive sense. Vast fields of the biology of *Drosophila* remain completely unsurveyed in this work—in particular, its biochemistry, its physiology, and its ecology, to say nothing of its genetics and evolution. Those, of course, would require additional volumes, and it is good that this one was not withheld until the day when those works, if ever, will be written. Still, the present volume might more appropriately have been called "The Morphology of Drosophila," for its approach and content are almost wholly morphological, if one may include as an aspect of morphology the cytological consideration of spermatogenesis which forms the first section of the volume; and if one may except the ecological notes included in the final contribution.

Even as a treatise on the morphology of a particular species, the volume is incomplete. The invaluable consideration of Normal Spermatogenesis in *Drosophila*, by Kenneth W. Cooper, logically requires as complement an equally comprehensive and critical consideration of oogenesis, but for this we must wait indefinitely. The anatomy and histology of the developmental stages are covered comprehensively in 3 sections, The Early Development of *Drosophila melanogaster* (B. P. Sonnenblick), Histogenesis, Organogenesis, and Differentiation in the Embryo of *Drosophila melanogaster* Meigen (D. F. Poulson); and The Postembryonic Development of *Drosophila* (Dietrich Bodenstein). These accounts are well integrated with one another, and while there are minor gaps still to be supplied in the picture, the discussion, so far as it goes, can be regarded as definitive.

Two contributions deal with the imago: External Morphology of the Adult (G. F. Ferris); and The Internal Anatomy and Histology of the Imago of *Drosophila melanogaster* (Albert Miller). With regard to the former it must be said that only time will decide whether the rather dogmatically asserted views advanced by Ferris, on the basis of his own and his students' study of the comparative morphology of the Diptera, Mecoptera, Neuroptera, Annelida, and Crustacea, offer a sound interpretation of the evolutionary modification of anatomical parts, or not. Many geneticists, the reviewer included, would agree on the basis of their genetical theory with the assertion that "actually there appear to have been but two revolutionary changes in the course of evolution of the Arthropoda from some annelid-like ancestor. One arose with the development and utilization of chitin, through which great modifications of the body were imposed upon the fundamental system of segments. The other was the development of wings in the insects, and this was probably not as revolutionary as it appears on the surface to have been." Other geneticists, in particular Goldschmidt, would no doubt disagree. In any case, it is most surprising to find so detailed a consideration of the external morphology of *Drosophila melanogaster*, including a consideration of evolutionary changes, that completely ignores the wealth of knowledge and insight provided by the numerous mutant forms which have received such painstaking study. Particularly in the study of the thorax and its appendages, this ignorance of or blindness toward the existence of critical, relevant observations based on mutant forms is surprising beyond belief. As a result, this section will be very useful to geneticists for the information it contains and for the theoretical interpretation Ferris has developed. On the other hand, for the non-geneticist who might want to know what the study of the hundreds of *Drosophila* mutants has added to the field of insect morphology, there is nothing whatsoever. As a well-rounded, thorough consideration of all the evidence available and a definitive statement of theory, this section is therefore clearly the weakest section of an otherwise outstanding book. Miller's contribution avoids this difficulty because *Drosophila* geneticists have hitherto paid little or no attention to the interior of the imago, except for its gonads.

The final section of the book, on Collection and Laboratory Culture (Warren P. Spencer), supplies what little the book contains on the natural history of this famous insect. The contribution, however, is focused on methods of capture, methods of shipping, methods of culturing, etherizing for examination, control of temperature, collection of eggs, control of parasites, etc., and the ecological notes are in a sense byproducts. The field of *Drosophila* work therefore still needs a comprehensive account of the ecological relations of the species. Moreover—and this is no fault of the author of this section but a consequence of the rapid development of work along new lines and by means of new

methods—many of the methods described here are already outmoded, and many new methods, particularly in population studies, are being introduced. This section will consequently require revision at a rather earlier date than other portions of the book.

A word must be said about the illustrations. The relatively high price of the volume is in large part due to the inclusion of the 341 figures, a majority of which are half-tones. Reproduction of these is in most cases adequate, although clearer definition would sometimes be desirable. The diagrammatic drawings are uniformly good, and serve to supplement and clarify the text in excellent fashion. Each section of the book has an extensive list of references, and much effort was obviously spent to make the two indexes (of authors cited and of subjects) as complete and serviceable as possible.

In conclusion, let it be repeated that the deficiencies of the book which have been pointed out constitute in reality not so much flaws in an invaluable reference work as indications that the need for a complete *Biology of Drosophila* remains unfilled. A supplementary volume to summarize the missing aspects of the subject is seriously needed. All we can hope is that, if such a book does eventually appear, it will meet the very high standards set by its predecessor.

BENTLEY GLASS

PRIMARY ANATOMY. *Second Edition.*

By H. A. Cates. The Williams & Wilkins Company, Baltimore. $6.00. x + 344 pp.; ill. 1951.

This textbook, at once ambitious and readable, begins with a discussion of protoplasm and the cell and covers the systems of the body in considerable detail. The 405 drawings contribute greatly to the unity and clarity of the text. This book can be expected to frame an adult and adequate course for non-medical students who have had no previous biological instruction.

JOHN A. CAMERON

AN ATLAS OF ANATOMY FOR ARTISTS. *First American Edition.*

By Fritz Schider; revised by M. Auerbach; with contributions by Franz V. Stuck; translated by Bernard Wolf from the Sixth Revised Edition. Dover Publications, New York. $6.00. xxvii + 116 pl. 1951.

It is gratifying to see this German classic translated into English. The publishers have done well to leave this excellent work untouched except for the presumably judicious editing of a few photographs. The introductory part of the book treats the skeleton, as the artist, rather than the anatomist, wishes to know it. There are many simple, bold sketches, and many well modeled pen and ink drawings, none of which overdoes the subject. Gross structures are presented comprehensively, and one cannot miss the forest for the trees. The section on muscles in relation to various body postures is especially valuable because it shows clearly how these underlying structures are responsible for what the artist sees on the surface. Photographs are placed beside analogous pen and ink diagrams to facilitate muscle analysis. Occasionally there appear cross-sections which might at first be thought unnecessary, but they will serve a useful purpose after the more familar portions of the book have been digested. Photographs and sketches of the living model are included, and although these will appear dated, it should be remembered that the aim of the publishers was to present a translated classic, not to modernize or revamp it. One familiar with the original will note that in this translated edition the pictures appear, to a minor degree, less distinct. The difference in the paper used will account for this. Very little of this book could be classed as "window dressing." It is a vigorous and forceful presentation of useful anatomical material for the artist.

WM. E. LOECHEL

APPLIED ANATOMY FOR NURSES.

By E. J. Bocock and R. Wheeler Haines. The Williams & Wilkins Company, Baltimore. $3.50. xii + 320 pp.; ill. 1951.

The authors have produced a lively and well organized book, made attractive by more than 200 black and white drawings which really illustrate, and form an integral part of, the text. The chapters on the Thorax and Lungs, and on the Female Pelvis and Reproduction are particularly well done.

JOHN A. CAMERON

ANATOMY AND PHYSIOLOGY FOR NURSES.

By W. Gordon Sears. Edward Arnold & Company, London. $2.50. viii + 395 pp.; ill. 1951.

This small, well-illustrated book is an adequate introduction to its field. It is simply worded yet not "written down," and may well serve as a hand-book for the nurse after graduation. There are review questions at the end of each chapter, and the index is adequate. The author is to be congratulated on having met the five objectives he has set for himself in his Preface.

JOHN A. CAMERON

ANATOMY AND PHYSIOLOGY LABORATORY MANUAL.

By Verna March Vogel; assisted by Jesse D. Perkinson, Jr. C. V. Mosby Co., St. Louis. $2.75 (paper). 194 pp.; ill. 1949.

Designed for student nurses, but arranged to be in-

dependent of the use of any particular textbook, this laboratory manual covers work with the human skeleton, histological slides, living frog, and embalmed cat. Physiological as well as morphological studies are included.

HISTOLOGIE UND MIKROSCOPISCHE ANATOMIE DES MENSCHEN. *Zweiter Band—Organe und Systeme.* *By W. Bargmann. Georg Thieme Verlag, Stuttgart; Grune & Stratton, New York.* DM 45.- xii + 563 pp.; ill. 1951.

The first volume of this textbook (*Q.R.B.*, 26: 418. 1951) was disappointing, but the second volume, to be reviewed here, is an improvement in every respect. Its physical appearance is enhanced by better binding and a finer grade of paper. The latter feature has promoted excellent reproduction of the illustrations, most of which are of high quality. They range from color plates (quite adequate, but not outstanding) through the various achromatic media to line drawings and diagrams, and are well chosen. The text itself is concise and clear, the style being much less involved than in the Volume One.

The organization of the subject matter differs in minor details from that of textbooks in English, but coverage is as complete as can be expected in a work of this size. Purely structural characteristics, as revealed by the optical microscope, are featured. Some attention, however, has been given to cytochemical studies and the analysis of ultrastructure. The references at the end of each section are largely German language contributions, but numerous significant ones from other sources are included.

It is difficult to evaluate the 2 volumes of this work as a whole. Highly commendable progress in post-war reconstruction is evident in the physical appearance of the second volume and indeed, in all its features. Some reworking of Volume One would raise Bargmann's textbook to an enviable position in its field.

F. N. Low

THE ORGANIZATION OF BONES. *By P. Lacroix; translated from the Amended French Edition by Stewart Gilder. The Blakiston Company.* $6.00. viii + 235 pp.; ill. 1951.

The original French edition of this monograph has already been reviewed (*Q.R.B.*, 26: 305. 1951). The translation, free but accurate, makes this excellent contribution more readily accessible to English-speaking scientists. It has been brought up to the date of correction of the translator's proofs (December, 1950), chiefly in a 4-page section, Additional Notes, at the end of the book. The quality of the paper is better. The illustrations are the same, but the half-tone figures are notably improved by better reproduction. This fine work is recommended to biologists in general and is indispensable to those interested in bone.

F. N. Low

THE RELATION OF THE ADRENAL CORTEX TO THE STRUCTURE AND PHAGOCYTIC ACTIVITY OF THE MACROPHAGIC SYSTEM. *Ann. N. Y. Acad. Sci., Vol. 52, Art. 1. By Albert S. Gordon and Grace F. Katsh. New York Academy of Sciences, New York.* $1.00 (paper). 30 pp.; ill. 1949.

A report of evidence indicative of a considerable stimulating effect of the adrenal cortex on the macrophagic system, an important and hitherto neglected aspect of cortical function.

THE BREAST: *Structure, Function, Disease.* *Edited by F. D. Saner. The Williams & Wilkins Company, Baltimore (printed in Great Britain).* $8.50. xii + 316 pp.; ill. 1950.

A number of authors have cooperated in the preparation of this book. They treat first the subject of the development, structure, and function of the normal breast. This is followed by text matter related to anomalies of form and function. The last part of the book includes detailed discussions of diseases of the breast and the therapeutic measures to be used in the care of the disorders. A short bibliography is given at the end of each chapter. The book is well illustrated with numerous drawings and photographs. An appendix of 14 tables gives data on mammary cancer. The index refers both to text and figures, and a quick check has shown that the index has been well prepared. A book covering so much material in a limited number of pages can be expected to lack details in some parts, but the book has much that is good.

Following the presentation of the section on the development, anatomy, and physiology of the breast, including consideration of the changes related to the various stages of woman's life cycle, the authors take up lack of development and excessive and precocious development of the breast. Detailed explanations by text and illustrations are used to show how to examine the breasts and nodes. The authors emphasize critical criteria in the differential diagnosis of benign and malignant lesions in clinical examinations. Methods are given for collecting tissue to be used for histological diagnosis. Attention is called to dangers, disadvantages, and limitations believed by the authors to be associated with biopsy by surgical incision. They cite the good points for and failures with aspiration biopsy, and present one of the authors' methods for cannula biopsy, which to him seems a desirable procedure.

Mammary dysplasia, benign tumors, and diseases of the skin and nipple are next discussed. The method of presenting the material is to describe the pathology and clinical aspects of each disease, and to give pertinent case histories. In some instances the authors refer to the use of hormones in treatment. This suggestion may be disturbing to some readers, but the authors do caution against unnecessary use of estrogen because of the possibility that it may prove dangerous as a carcinogen.

Breast cancer occupies a considerable part of the subject matter. The authors first cite factors which are of possible etiological significance. Critical symptoms are identified. Attention is called to the internal mammary lymphatic chain as a path of invasion. In support of the significance of this chain, the authors refer to a preliminary study on the frequency with which the second intercostal space node of the chain is involved in breast cancer cases. The findings were significant enough for the author to describe in considerable detail the chain and the procedure for surgical removal of the intercostal space gland.

Detailed descriptions are well illustrated by figures of operative procedure for mastectomy. The theory and practical application of irradiation in radiotherapy are also described in detail. The author of the final chapter considers plastic surgery for the correction of faulty scars and x-ray dermatitis and for restoration of mammary prominence. Surgical procedure is given for the treatment of pendulous and hypertrophic breasts.

CLARENCE P. OLIVER

DOCUMENTA OPHTHALMOLOGICA. *Advances in Ophthalmology. Vol. V–VI.*

Edited by G. von Bahr, J. ten Doesschate, H. Fischer-von Bunau, J. Francois, H. Goldmann, G. LoCascio, H. K. Müller, Jean Nordmann, A. J. Schaeffer, and Arnold Sorsby. Dr. W. Junk, The Hague. f. 72.00. viii + 588 pp. + 45 pl.; text ill. 1951.

This volume is a tribute to F. P. Fischer, one of the founders and latterly the editor-in-chief of the *Documenta* series, who died in 1949. A brief vita and complete bibliography are given.

The rest of the volume is a collection of 17 papers, diverse in nature, but dealing with topics of interest mainly to ophthalmologists and visual physiologists. It is an international collection with authors representing eight countries and with articles in French, German, and English. The authors and titles of the papers follow: Retinal Cysts and Cystoid Degeneration of the Retina (F. P. Fischer); A Case of Tritanopy (F. P. Fischer, M. A. Bouman, and J. ten Doesschate); The Sugar Concentration of the Subretinal Fluid in Cases of Ruptured Detachment of the Retina (F. P. Fischer and R. W. v. Nordheim); "Reefing" of the Sclerotic in Conjunction with Diathermy-Coagulation of Retinal Holes (H. J. M. Weve); The Polarization of the Sky, its Meaning and Importance (A. v. Tschermak-Seysenegg); Essential Shrinking of the Conjunctiva in a Hereditary Affection Allied to Epidermolysis Bullosa (A. Sorsby); Electrical Stimulation of the Human Eye by means of Periodical, Rectangular Stimuli (M. A. Bouman, J. Ten Doesschate, and J. v. d. Velden); Stereopsis (H. M. Burian); Growth Pressure and Metaplasia of Conjunctival and Corneal Epithelium (J. S. Friedenwald); The Terminology of the Biomicroscopically Visible Elimination of Aqueous Humour (K. W. Ascher); Choroidal Tumors—their Appearances, Forms, and Origin (J. Nordmann and A. Brini); The Out-flow Pressure, Volume, and Resistance of the Fluid Current in the Anterior Chamber of the Human Eye (H. Goldmann); The Practical Significance of Blood-pressure Measurements in the Central Artery of the Retina (E. Weigelin and H. K. Müller); Some Problems of Protein Chemistry of the Eye (A. J. Schaeffer); Slit-lamp Microscopy and Ophthalmoscopic Studies on the Eye of Rats and Mice (R. Brückner); Pathogenesis of Capsular Glaucoma (L. Weekers, R. Weekers, and J. Dedoyard); and Relationships between the Air and Gases in the Conjunctiva, Cornea, and Anterior Chamber (C. Koch).

A. CHAPANIS

ATLAS OF CROSS SECTION ANATOMY OF THE BRAIN. *Guide to the Study of the Morphology and Fiber Tracts of the Human Brain.*

Based on the fifth section of Emil Villiger's Brain and Spinal Cord, 14th edition, revised by Eugen Ludwig, and further revised by A. T. Rasmussen. The Blakiston Company, Philadelphia, New York, and Toronto. $5.00. 63 pl. 1951.

The celebrated Villiger drawings (51 figs.) from section V of Villiger-Ludwig's *Gehirn und Rückenmark* are here combined with drawings of a parasagittal series through the right cerebral hemisphere (12 figs.). The latter were derived from Weigert preparations made by Rasmussen at the University of Minnesota. Labeling nomenclature follows the BNA closely but has been chosen judiciously according to general usage. In the case of the thalamic nuclei the terminology of Walker (Crouch) has been followed. A 12 page index lists the figures in which the structures may be found.

However much neurological fashions and fads may change, the solid facts of neuroanatomy will remain unaltered. In this small but distinguished volume these facts are compactly, neatly, and accurately presented. Most appropriately it is the work of emminent neuroanatomists whose best known skill is neuroanatomical illustration. It is one of those rare scientific publications which can be relied upon to yield up fact without controversy, and is without a peer in its field.

F. N. LOW

A Synopsis of Neurology.

By W. F. Tissington Tatlow, J. Amor Ardis, and J. A. R. Bickford. The Williams & Wilkins Company, Baltimore. $6.50. xii + 513 pp.; ill. 1952.

As the authors suggest, this small synopsis of neuroanatomy and clinical neurology will be of great assistance to senior medical students and postgraduates studying for higher qualifications, and also, as a handy reference work, to general practitioners. It is not intended to replace the larger textbooks or hours of careful study, but presents in concise tabular form an outline of a vast amount of information. It is divided into sections on Anatomy, Disorders of Peripheral Nerves, Toxi-infective Diseases, Degenerative Disorders, Spinomuscular and Muscular Disorders, Cerebral Vascular Disorders, Lesions of the Spinal Cord, Intracranial Tumours, Congenital Disorders, and a so-called Miscellaneous Section (which includes Epilepsy, Migraine, Apraxia, Agnosia, Vitamin Deficiency, and Electro-encephalography).

Robert G. Grenell

Fundamentals of Neurology. *Second Edition, Illustrated.*

By Ernest Gardner. W. B. Saunders Company, Philadelphia and London. $4.75. xii + 359 pp.; ill. 1952.

In the preface to the first edition of this little book, the author suggested that it would be useful for nurses, physiotherapists, occupational therapists, etc. I am inclined to agree. It not only presents a certain amount of the structural and functional information concerning nervous tissues, but also points up their relation to clinical problems. As a small manual for people working in fields where some knowledge of the nervous system is necessary or advisable, this book could serve a useful purpose.

Robert G. Grenell

ANIMAL PHYSIOLOGY

Regards sur l'Organisme Vivant. *Invitation à la Physiologie.*

By Léon Binet. Gallimard, Paris. 430 fr. (paper). 252 pp. + 3 pl.; text ill. 1949.

In a series of short chapters, the author summarizes some of the work from his laboratory on different aspects of physiology. In these are detailed and interpreted illustrative experiments bearing on such diverse problems as: shock, respiratory failure, liver disease, endocrine disorders, muscular fatigue, defective heat regulation, senescence, and biological and clinical death. There are a number of philosophical comments in each chapter and many interesting and previously unpublished extracts from Claude Bernard's notebooks. As indicated by the subtitle, Invitation à la Physiologie, the book is intended for young students and for the educated public.

F. Chinard

Laboratory Exercises in Invertebrate Physiology.

By John H. Welsh and Ralph I. Smith. Burgess Publishing Company, Minneapolis. $2.75 (paper) v + 126 pp.; ill. 1949.

As the authors have pointed out, this manual is most useful in courses where comparative and invertebrate physiology are taught on a flexible and independent basis. Since it is intended primarily to aid students in becoming acquainted with scientific journals and to develop powers of ingenuity and original thinking, step-by-step descriptions of procedure are largely omitted. Accordingly, the manual is best suited for advanced undergraduate courses and for small courses where routine handling of students is not forced upon the instructor. Having used the present manual and its mimeographed predecessor for a period of 5 years, I have found it well suited to students who have initiative and a certain amount of independence. It is excellent for indoctrinating students in research method. More than 75 experiments in the fields of feeding, digestion, respiration, circulation, osmotic regulation, excretion, coordinating systems, effector systems, receptor systems, and response mechanisms are described. Each description contains background information and a concise set of references. The manual is highly recommended.

V. G. Dethier

Human Physiology.

By Bernardo A. Houssay and six other contributors; translated by Juan T. Lewis and Olive T. Lewis; foreword by Herbert M. Evans. McGraw-Hill Book Company, New York, Toronto, and London. $14.00. xvi + 1118 pp.; ill. 1951.

This textbook of physiology has been avowedly written to present "the fundamental principles of modern physiology" to medical students. A pleasing two-column format does not prevent the physical weight of the volume from approximating that of the several textbooks in current use, which are already too large and contain much too little. In a gracious introduction, Herbert Evans comments that this book is the product of "a group of men who not only are fruitful investigators but who, working where science has not hitherto been intensively cultivated, have felt themselves forced to study conscientiously the literature in mammalian physiology produced throughout the world. They

have thus the perspective necessary for a balanced account." However, in a survey of the literature citations it appears that the great majority are from North American publications—no extensive veins of intellectual wealth are revealed which have been hitherto unexplored by Anglo-American physiologists. Nor does the arrangement or choice of material present any clear advantages over those of existing textbooks. Perhaps the better textbook which many of us desire has to await a fundamental maturation and quantitation of the subject.

In spite of numerous literature citations, there is some tendency on the part of the authors to dogmatic and undocumented assertion. To take one example, in a listing of extragenital secondary sexual characters in the human species, we find included as male psychic characters "initiative, capacity for abstract thinking, idealism, interest in social problems," and as female psychic characters "more highly developed emotivity, family sentiments and practical outlook." No literature is cited as a basis for these axioms, and we are left without any indication whether anthropological and psychological research has presented evidence of any such innate categorization that is acceptable to all serious students of mental characteristics. Aside from the consideration that abstract thought, strictly speaking, may not exist except as a verbal dismemberment, one would be forced to conclude that the worthy book lists heavily to the feminine side, as it emphasizes such practical matters as nutrition, reproduction, and subservient neuromotor and circulatory mechanisms, with little attention to that fragile orchidic abstraction, cellular physiology at a molecular level.

EVELYN HOWARD

PRINCIPLES OF HUMAN PHYSIOLOGY. *Eleventh Edition. Originally written by E. H. Starling.*

By Sir Charles Lovatt Evans; with chapters on the Special Senses by H. Hartridge. Lea & Febiger, Philadelphia. $11.00. xii + 1210 pp. + 5 pl.; text ill. 1952.

The eleventh edition of this work, familiar to all who teach or practice mammalian physiology, has been revised to include information available to the authors up to 1952. The text is quite up to the high standard of most British authors, and the plates and figures are all well reproduced.

If there be any criticism, it is only that not enough emphasis is placed on the very new and, in some cases, revolutionary work now being accomplished in the fields the book encompasses. This, however, will probably be true of textbooks as long as they continue to be written.

STANLEY G. FRIEDMAN

THE PHYSIOLOGY OF TISSUES AND ORGANS

By Douglas H. K. Lee. Charles C Thomas, Springfield, Ill. $4.00 x + 159 pp.; ill. 1950.

The Physiology of Tissues and Organs is a short, well-written book intended to introduce the student to the study of physiology. It is well suited to a short introductory or survey course in physiology or for use as an adjunct to other textbooks in more intensive courses. The text is divided into 2 parts, the first serving to acquaint the student with the properties, structure, and functioning of living cells as well as the specific tissues. Part Two considers the various organs and organ systems, such as absorptive organs, storage organs, effector organs, and organs of sensation.

The clear, concise style, and the excellent organization have made this small book a pleasure to read. Although the small size of the book precludes any detailed presentation of facts and theory, the clear emphasis upon basic principles of tissue function will give the student a solid basis and a sure orientation for further work.

C. W. ERIKSEN

THE PHYSIOLOGICAL FOUNDATION OF DENTAL PRACTICE.

By L. L. Langley and E. Cheraskin. The C. V. Mosby Company, St. Louis. $8.25. iv + 511 pp.; ill 1951.

Here is a "selective" textbook rather than one "written down" for dental students. Student interest and practical considerations have been emphasized. The illustrations are numerous and well chosen. Any experienced teacher will be struck with the omission of wide fields in the book. Nevertheless, one must admit that wide fields would have to be omitted if one attempted to use a standard medical textbook in the reduced time commonly allotted to Dental College physiology.

JOHN A. CAMERON

ORAL PHYSIOLOGY.

By John T. O'Rourke; edited by Leroy M. S. Miner. C. V. Mosby Company, St. Louis. $5.00. 333 pp. 1951.

By the time the average American reaches the age of 40 he has lost more than half his natural teeth. By the age of 60, about half of the population have lost all their teeth. If loss of teeth can be considered a disease, this is a spectacular one. The incidence of dental caries is on the increase. With the increase in life expectancy, it can be anticipated that more people will be seriously handicapped from the point of view of masticatory function when they reach the age of 50.

The late Dr. O' Rourke takes issue with those med-

ical men who see no point to being concerned with dental problems and who hold that "teeth are trivial." He has prepared a book that is unhesitatingly recommended for any who are interested in oral hygiene and public health. It is exceptionally well written and well organized and deals with such subjects as (1) the prevalence of dental disease; (2) the chief function of the mouth; (3) mastication; (4) mastication in domestic animals; (5) mastication in its relation to deglutition, other parts of the alimentary tract, to taste, smell and other sensations, and its significance in children and older people; (6) factors which interfere with normal mastication and the adaptations to deficient masticatory function; and (7) the relation of the physical character of the diet to the health of supporting tissue. Most of the chapters contain adequate summaries. The bibliography is excellent. However, the index leaves much to be desired.

DAVID B. TYLER

BLOOD CLOTTING AND ALLIED PROBLEMS. *Transactions of the Fourth Conference, January 22–23, 1951, New York.*

Edited by Joseph E. Flynn. Josiah Macy, Jr. Foundation, New York. $4.00. 272 pp.; ill. 1951.

This report is identical in scope and make-up with those of the 3 preceding conferences which have previously been discussed in this journal. It includes 7 major papers and a full transcript of the discussions, which are critical and comprehensive and unobtainable elsewhere.

Knisely reviews his work on the sludging of blood and discusses its significance as a factor predisposing to thrombosis. Brinkhous reports studies on canine hemophilia, which closely resembles the human disease in both its hematologic and genetic features. Their studies on the genetics of the disease are exceptionally thorough and significant, proving the occurrence of the disease in female animals and its transmission, as would be anticipated, as a recessive sex-linked character.

Two papers (Wright; Zucker) deal with blood platelets, particularly regarding methods of estimating their adhesiveness and factors which alter this property. Seegers discusses antithrombic activity, and Laki describes the physical and chemical changes observed in the transition of fibrinogen to fibrin.

These papers are highly technical and will primarily be useful, and indeed invaluable, to those working in this field. Numerous tables, charts, and illustration add greatly to the clarity of the presentations. Physicians and scientists with a good basic knowledge of the subject will also find much of interest, but the book is not well suited for beginners.

PAUL W. CLOUGH

PROTHROMBIN DEFICIENCY. *Publication Number 121, American Lecture Series. A Monograph in American Lectures in Hematology.*

By Rosemary Biggs. Charles C Thomas; Springfield, Ill. $2.50. x + 83 pp. 1951.

This small monograph is not a laboratory manual, nor does it cover systematically the entire subject of blood coagulation. Those phases of the subject which bear directly on prothrombin deficiency are discussed from both theoretical and practical standpoints, and the technics of a one-stage and of a two-stage test are outlined. The point is emphasized that neither procedure actually measures prothrombin, but that both yield valuable information of different sorts. The volume is written with exceptional clarity and can be followed by the average reader without an extensive knowledge of the subject.

P. W. CLOUGH

FACTORS REGULATING BLOOD PRESSURE. *Transactions of the Fifth Conference, February 15 and 16, 1951, New York.*

Edited by Benjamin W. Zweifach and Ephraim Shorr. Josiah Macy, Jr., Foundation, New York. $3.75. 238 pp.; ill. 1951.

The Transactions of the Fifth (and last) Macy Conference on Blood Pressure include 11 papers on pertinent subjects and full informal discussions, in which the differing views of the participants are clearly shown. Some of the material presented has been previously published, but much of it is new, and the papers in general represent reports of work in progress.

Five papers (Barr; Kendall; Gofman; Simms; Katz) are concerned with lipids and lipoproteins and their relation to human and experimental atherosclerosis. Other papers deal with the part played by blood pressure, blood flow, and anatomic and pathologic changes in the media and intima in determining the localization and extent of atherosclerotic lesions.

The material presented is of great current interest and importance, and the book provides a valuable and authoritative source of information regarding these controversial subjects. It should be read by clinicians as well as investigators in this field.

PAUL W. CLOUGH

RECENT PROGRESS IN HORMONE RESEARCH. *The Proceedings of the Laurentian Hormone Conference. Vol. VI.*

Edited by Gregory Pincus. Academic Press, New York. $8.50. vii + 431 pp.; ill. 1951.

This record of the Proceedings of the Laurentian Hormone Conference, held in September, 1950, is one

of the better recent symposia on the endocrines, and contains a number of substantial and interesting papers. The better papers record most impressive progress and widening of horizons in very active fields.

The 12 papers fall into 5 groups: (I) Gonad Development and Function, (3 papers, by Emil Witschi, W. O. Nelson, and S. Zuckerman, respectively); (II) The Use of Isotopes in Hormone Problems (2 papers, by K. Bloch, and by T. F. Gallagher et al.); (III) Hormones and Metabolism (D. J. Ingle); (IV) Chemistry, Physiology, and Clinical Endocrinology of the Adrenal Cortex, (5 papers, by P. J. Julian, O. Hechter et al., R. Gaunt, F. L. Engel, and R. J. Sprague et al., respectively); and (V) Hormone Therapy in Cancer (by O. H. Pearson and L. P. Eliel).

EVELYN HOWARD

SYMPOSIUM ON STEROIDS IN EXPERIMENTAL AND CLINICAL PRACTICE.

Edited by Abraham White. The Blakiston Company, Philadelphia, New York, and Toronto. $4.50. 415 pp.; ill. 1951.

This record of the first annual steroid conference held in Cuernavaca, Mexico, in January 1951, contains 24 papers and records of discussions. The specific tasks of this conference were to study the present status of knowledge regarding the role of 11-desoxy steroids in animals and man, and to evaluate, if at all possible, the present or future clinical application of these compounds, which deserve intensive study because they are now available in far greater quantities than are the 11-oxy steroids. Non-clinical papers included: Physiology and Pharmacology of the 11-desoxy Steroids (Hans Selye); Effect of Pregnenolone and Progesterone upon Cardiac Muscle (L .H. Nahum et al.); Studies of Steroids for Inhibition of Normal and Abnormal Growth (C. C. Stock et al.); Antifibromatogenic Action of Steroids . . . (S. Bruzzone et al.); The Adrenal Cortex and its Secretory Products (A. Zaffaroni); Adrenal Function and Steroid Excretion (K. Dobriner). These are followed by 15 clinical papers regarding steroid therapy in arthritis and neoplastic disease. The non-clinical papers are rather short presentations of interesting points of view and of work in progress. Experimental details are frequently omitted, the presentations generally serving as a basis for discussion rather than as definitive scientific reports.

EVELYN HOWARD

PHYSIOLOGY AND PHARMACOLOGY FOR PHARMACEUTICAL STUDENTS. *Third Edition.*

By Harold Hayden Barber. The Williams & Wilkins Company, Baltimore. $6.50. x + 622 pp.; ill. 1951.

This is a third edition of a fairly well known textbook well suited for pharmaceutical students. It is about 100 pages longer than the previous edition, the emphasis again being on the physiological rather than the pharmacological aspects.

THE PHARMACOLOGIC PRINCIPLES OF MEDICAL PRACTICE. *2nd Edition.*

By John C. Krantz, Jr., and C. Jelleff Carr. Williams & Wilkins Co., Baltimore. $10.00. xviii + 1116 pp. + 5 pl.; text ill. 1951.

The second edition of this textbook of pharmacology has been considerably revised to include much new material that has been published since 1949. I have found it to be a highly acceptable textbook for medical pharmacology and to be very popular among students because of its clarity and style. I would like to recommend specifically the excellent sections on motion sickness and sleep.

DAVID B. TYLER

OUTLINE OF FUNDAMENTAL PHARMACOLOGY. *The Mechanics of the Interaction of Chemicals and Living Things.*

By David Fielding Marsh. Charles C Thomas, Springfield, Ill. $6.00. xxxi + 219 pp.; ill. 1951.

According to the author, this textbook has been designed to explain the aims and purposes of the pharmacologist for the student of chemistry, pharmacy, or medicine, or for the research worker in any of these fields. This has been accomplished in a very lucid manner by describing the curious phenomena of dose-effect relationships as concerned with biological variation, bioassays, and drug antagonism. A further consideration is given to methods for the localization of the site of action of drugs, absorption and distribution, and the fate of drugs in the animal body. The general problems of the mechanism of action of drugs, and of chemical constitution and biological action are discussed in considerable detail.

While not a textbook of pharmacology in the usual sense, this volume fulfils the original aim. The section dealing with the response of (animal) populations to drugs is a modern presentation of the subject, and one that is sufficiently clear and explicit for the research worker to use as a guide in his own work. The volume is a valuable contribution to the field of pharmacology.

C. JELLEFF CARR

SELECTIVE TOXICITY WITH SPECIAL REFERENCE TO CHEMOTHERAPY. *Methuen Monographs on Biochemical Subjects.*

By Adrien Albert. John Wiley & Sons, New York; Methuen & Co., London. $1.75. xii + 228 pp.; 5 pl. 1951.

This is a very interesting, readable book that reviews the mode of action of selectively toxic agents from the standpoint of present knowledge. Special consideration is given to the nature of (1) the drug-receptor bond and the principal bonds that are likely to be met; (2) the effect of very small alterations in chemical constitution upon selective toxicity; (3) those antagonists which are chemically similar to the metabolites whose activities they suppress; (4) the importance of the degree of ionization of every selective toxic agent (information of this sort can save months or years of work in synthesizing compounds, and is now generally employed with the current empirical methods); (5) the nature of the bond between a metallic ion and an organic molecule (chelation); and (6) the underlying principles of chemotherapy.

This book is highly recommended. Undoubtedly graduate students and investigators in a variety of the biological and medical sciences will find something in it of considerable interest to them.

DAVID B. TYLER

PHYSIO-PATHOLOGIE DE L'ACIDE OXALIQUE CHEZ L'HOMME. *Diathèse Oxalique.*

By Joseph Khouri; preface by Maurice Loeper. Masson & Cie., Paris. 400 fr. (paper). 120 pp. + 2 pl. 1948.

THE MODE OF ACTION OF ANAESTHETICS.

By T. A. B. Harris. The Williams & Wilkins Company, Baltimore. $8.00. xii + 768 pp. + 1 pl. 1951.

This book has been written for medical students, and aims at giving both a theoretical and a practical foundation in the field of anesthetic action. The potential audience for this work is a much larger one, as physiologists and other workers in the field of experimental biology will find many practical details of interest to them. The organization of the subject matter is excellent and, quite obviously, the clinical parts of the book reflect a very considerable experience with a variety of anesthetic agents. Harris has developed a novel method of classifying those anesthetic agents in current use in terms of their partition coefficients and of whether they produce a "standard sequence of depression."

In a work of such scope as this there are bound to be errors, and this situation obtains especially in the more theoretical parts of the book. It is to be hoped that subsequent editions will permit the elimination of these errors so that the work itself will enjoy a position of authority that, over-all, the book merits.

Part One is devoted to narcotics and a consideration of the general principles of drug action. This is the only section of the book considered weak, not only because of errors, but because the presentation does not properly reflect the present status of the subject. Partition coefficients are defined as the "solubility of a substance in oil/solubility in water," the lipid theory of narcosis is criticized by misstating facts, and the controversial nature of the mechanism of narcosis is concealed by an assertion to the effect that it is quite clear that narcotics act by inhibiting certain dehydrogenases or other enzyme systems. It is unfortunate that the discussion ignores the work of Ferguson and others who have done so much to develop thermodynamic interpretations of narcosis.

In Part Two, the discussion is of anesthetics. Here the author is on much surer ground and does an excellent job of distinguishing the sequence of physiological events that make for a practical anesthetic, in contrast to other chemical agents, which produce only a narcotic or a combined narcotic-anesthetic action. A detailed physiological sequence for anesthetic uptake, distribution to tissues, and fixation is worked out, and a revision of the Guedel anesthetic levels is presented.

The two closing sections of the book consider the level of anesthetic depression and metabolism during anesthesia. The literature citations appear to be most adequate, and their discussion and general treatment is excellent.

L. J. MULLINS

INDIVIDUAL DIFFERENCES IN COLOUR VISION.

By R. W. Pickford. Routledge & Kegan Paul, London. 30s. xviii + 386 pp. + 1 pl.; text ill. 1951.

This book is primarily a research monograph describing the results of extensive investigations carried out by the author over a period of 8 years. In it, Pickford meticulously summarizes findings on 1100 normal and 138 color-defective subjects who were examined with a special set of laboratory tests devised by him. Among other things, Pickford carried out some detailed genetic studies on a number of his subjects, and the pedigrees he gives should be of interest to biologists.

Pickford is a staunch supporter of a four-color theory of vision, and the evidence he adduces to support his views is compelling. This is a book no scientist studying color vision can afford to miss.

A. CHAPANIS

ANIMAL NUTRITION

NUTRITION FOR HEALTH.

By H. F. Kilander. McGraw-Hill Book Company, New York, Toronto, and London. $3.00. xvi + 415 pp.; ill. 1951.

This is primarily an elementary textbook of nutrition written for high school students. The objective of the volume is to present information which will aid in the selection of an adequate, well-balanced diet. Numerous illustrations of deficiencies in animals, charts, and tables of food values are presented. However, the functions of the various nutrients are described only in very general terms. The Recommended Daily Dietary Allowances of the Committee on Food and Nutrition of the National Research Council are discussed adequately. One interesting feature of the book is the section on superstitions about food.

R. VAN REEN

A STUDY OF INSTITUTIONAL CHILDREN WITH PARTICULAR REFERENCE TO THE CALORIC VALUE AS WELL AS OTHER FACTORS OF THE DIETARY. *Monographs of the Society for Research in Child Development. Volume XIII, Serial Number 46, Number 1, 1948.*

By Pauline Beery Mack and Charles Urbach. Society for Research in Child Development, National Research Council, Washington, D. C. $2.00 (paper). x + 93 pp.; ill. 1949.

Children from 3 orphanages differing in the caloric value of their dietaries were subjected to a thorough study of physical status, dental status, skeletal status, height and weight, development, blood characteristics, heart functioning, urinary excretion, fatigue scores, corneal vascularization, darkness adaptation, condition of skin and gums, etc. The children from the orphanage with the superior caloric diet ranked highest, those from the orphanage with the lowest diet ranked lowest in respect to most of the criteria; although dark adaptation was poor in all 3 groups, in spite of the fact that the two higher groups exceeded or met the vitamin A recommendation of the Food and Nutrition Board. Feeding experiments were conducted on 234 boys in the orphanage with the highest dietary rating, and considerable improvement was noted over a 2-year period, in growth, skeletal development, blood values, diminution of obesity, heart performance, absence of fatigue, dark adaptation, and reflexes. Although consumption of sugar was higher than the average for the population in general, increase in dental caries was less.

BIOPHYSICS

BIOLOGICAL EFFECTS OF EXTERNAL BETA RADIATION.

By Raymond E. Zirkle. McGraw-Hill Book Company, New York. $3.25. xxv+ 242 pp.; ill. 1951.

This volume of the National Nuclear Energy Series contains the results of an extensive series of experiments on the effects of exposure to beta particles originating externally to the organism. The work was done at Clinton Laboratories at Oak Ridge during World War II and was made possible by the large scale production of P^{32} in the Clinton Pile. The book consists of 16 more or less independent chapters, each presenting one phase of the investigation, and written by one or more of the workers concerned in the project. This method of presentation leads to a certain amount of disunity and of repetition. A general summary chapter would have been helpful, though a real effort was made to point out connections between the different investigations.

The first chapter is concerned with methods of exposure and with dosage problems. Sheets of phosphorus-impregnated plastic were exposed in the pile to produce radioactive panels and plaques containing P^{32} formed by the P^{31} (n,γ)P^{32} reaction. These sheets were put together in various ways to form the exposure devices. Several methods of physical and biological dosimetry were used, and a rather detailed discussion of these methods and of depth dose problems is included. One is impressed with the ingenuity with which this part of the work was carried out.

The remaining chapters are concerned with a wide variety of studies upon rabbits, guinea pigs, rats, mice, baby rats, and human skin. Data were obtained on acute lethality, changes in body weight, and on gross anatomical, histopathologic, metabolic, and hematologic changes. In many cases, the animals were kept for many months until death eventually occurred, so that a rather complete picture of the whole course of events, including a variety of delayed effects, was obtained.

The action of beta particles is much like that of X and gamma rays. The major differences can be attributed to the low penetrating power of the former. Thus much of the effect can be attributed to damage to the skin, especially in such large animals as rabbits. However, Raper, Zirkle, and Barnes have presented evidence in Chapter 3 which is interpreted to mean that the lethal effects are due to toxic substances produced from the skin rather than to the destruction of the skin itself.

With beta particles they find little evidence for species-specific differences in the 50% lethal dose which could not be accounted for by differences in body weight, whereas with gamma rays such differences were observed. However, in other kinds of response the species differed, sometimes considerably.

Other equally interesting work on recovery, on the effects of periodic small exposures, on the action of combined beta and gamma radiation, etc., can be only mentioned in a brief review.

In general, one is impressed with the large quantity

of valuable data which were gathered in so short a time, the care with which the methods were worked out and validated, and the careful planning of experiments to answer a number of basic questions. It is not to be considered a criticism, but an unavoidable circumstance, that there are gaps in the work and that some of the investigations were not carried out to an entirely satisfactory conclusion.

R. F. KIMBALL

BIOCHEMISTRY

PLANT AND ANIMAL BIOCHEMISTRY.

By Edwin Theodore Mertz and John Willard Porter. Burgess Publishing Co., Minneapolis. $3.25 (paper). v + 198 pp. 1949.

This elementary outline is intended for undergraduate students in their first biochemistry course and places more than usual emphasis on matters pertaining to plants and agriculture.

PAPAIN. *Ann. N. Y. Acad. Sci., Vol. 54, Art. 2.*

By M. L. Tainter and 12 other authors. New York Academy of Sciences, New York. $3.00 (paper). Pp. 143–296; ill. 1951.

A comprehensive review of the potential therapeutic significance of the digestive enzyme papain. A literature review covering 338 references is presented by Kao Hwang and A. C. Ivy of the University of Ilinois. The remaining 10 sections were written by members of the staff of the Sterling-Winthrop Research Institute and include the following: Methods of Measuring Proteolytic Activity of Papain; Correlation of Beef-Digestion, Gelatin-Digestion and Milk-Clotting Methods of Measuring Proteolytic Activity of Papain; A New Method of Assay of Papain Employing Coagulated Egg Albumin; Effect of Temperature of Drying on Papaya Latex; Effect of Chemical Treatment and Drying Latex; Animal Studies Demonstrating in Vivo Activity of Papain; and Nitrogen Balance Studies in Dogs as Reflecting in Vivo Proteolytic Activity.

PROCESSUS EN CHAINE ET FACTEURS LIMITATIFS EN BIOCHEMIE ET EN BIOLOGIE. *Actualités Biochimiques —13.*

By H. P. Wolvekamp and H. L. Booij. Éditions Desoer, Liège; Masson & Cie., Paris. 250 fr. 78 pp.; ill. 1949.

This short monograph reviews succinctly but critically some of the formulations developed to date for the description of sequential reactions of importance in biochemistry and in various fields of biology.

An extensive section deals with kinetics and the concepts of limiting factors and of dominant processes ("master reactions"). A few formulations are derived for non-steady-state systems, but the most complex case treated in detail is that of two successive irreversible reactions. The steady-state condition permits consideration of much more complex systems because of the relatively simple mathematics required. Among the cases for which derivations are given are: parallel and irreversible reactions, sequential second order reversible and irreversible reactions, sequential reactions with an initial process of diffusion, and the effects of temperature and of catalysts. In all cases an expression is given for the over-all velocity, and in several cases the formulations are directly applied to appropriate experimental data. There are also brief sections on diffusion and biochemical processes. More extensive consideration is given to the role of temperature in sequential reactions and to the difficulties, not always apparent, of the interpretation of experiments on intact organisms.

The authors conclude cautiously that it may be impossible, in complex biological systems, to identify a limiting or dominant process, and that it may be difficult at best to obtain an adequate interpretation of the effects of temperature.

F. CHINARD

CARBON DIOXIDE FIXATION AND PHOTOSYNTHESIS. *Symposia of the Society for Experimental Biology, Number V.*

The Society for Experimental Biology. Academic Press, New York. $6.50. vii + 342 pp. + 5 pl.; text ill. 1951.

This volume, fifth in a series sponsored by the Society of Experimental Biology, contains 21 papers on various aspects of carbon dioxide fixation and photosynthesis, presented in a symposium held at the University of Sheffield in July, 1950. There have been several such symposia during recent years, but this one appears to be the most complete. In addition to a number of reviews, several original research articles heretofore unpublished are also included.

The first part of the symposium is concerned with the comparative biochemistry of carbon dioxide fixation. It includes: Carbon Dioxide Fixation in Animal Tissues (Krebs); A Consideration of Some Reactions Involving Carbon Dioxide Fixation (Wood); Biosynthesis of Dicarboxylic and Tricarboxylic Acids by Carbon Dioxide Fixation (Ochoa); Oxalacetic Decarboxylase and Carbon Dioxide Assimilation in Bacteria (Herbert); and Carbon Dioxide Fixation and Acid Synthesis in Crassulacean Acid Metabolism (Thomas). Next are discussed certain aspects of carbon dioxide fixation peculiar to plants: Assimilation by Green Leaves with Stomatal Control Eliminated (Heath); and Some Phys-

ical Aspects of Assimilation and Transpiration (Penman and Schofield). Some strictly photochemical phenomena are next considered: The Photochemical Formation and Reactions of Atoms and Radicals in Aqueous Systems (Evans and Uri); Photochemical Oxidation-reduction Processes in Aqueous Systems (Weiss); and Resonance Transfer of Energy between Molecules (Bowen). There is then a series of papers on the physical basis of photosynthesis: The Physical Background of Photosynthesis (Franck); The Maximum Efficiency of Photosynthesis (Nishimura, Whittingham, and Emerson); Extensions of Photosynthetic Experimentation (Warburg, Burk, and Schade); Photo-Induced Interactions in Metabolism of Green Plant Cells (Kok); Reduction by Chloroplasts (Hill); The Photochemical Reduction Process in Photosynthesis (French and Milner); and The Reducing Action of Light in Photosynthesis (Wassink). The problem of the early intermediates in photosynthesis is discussed in 2 papers: Intermediates in Photosynthesis: Formation and Transformation of Phosphoglyceric Acid (Gaffron, Fager, and Rosenberg); and Carbon Dioxide Assimilation in Plants (Calvin, Bassham, Benson, Lynch, Ouellet, Schou, Stepka, and Tolbert). The volume is concluded by 2 papers that deal essentially with problems in technique: Three-Vessel and One-Vessel Manometric Techniques for Measuring CO_2 and O_2 Gas Exchanges in Respiration and Photosynthesis (Burk, Schade, Hunter, and Warburg); and The Use of "CO_2-Buffers" in Manometric Measurements of Cell Metabolism (Krebs).

One feels while reading these papers that tremendous advances have been made in this field during recent years. Many points of controversy still remain, but new methods and techniques will certainly aid in their resolution. Both the reader interested in getting a general picture of carbon dioxide fixation and the research specialist will find much of interest in the papers in this symposium.

G. R. NOGGLE

THE BIOCHEMISTRY OF FISH. *Biochem. Soc. Symp. No. 6, Held at Derby Hall, University of Liverpool, September 22, 1950.*

Organized and edited by R. T. Williams. Cambridge University Press, New York and London. $2.75 (paper). 105 pp. + 1 folded table. 1951.

The importance of fish is illustrated by the fact that between 17 and 18 million tons of fish are caught each year throughout the world. About 6.5 million tons are consumed annually, though this represents no more than 2 per cent of the estimated total annual world consumption of 50 million tons of first class protein. The gap between the catch and the consumption is a reflection not only of the other uses of fish as fertilizer or in various industries, but also of the biochemistry of fish.

The first contribution to this symposium is by Baldwin, whose subject is the comparative biochemistry of fish. In this paper the biochemical and physiological differences between fresh-water and marine species are pointed out. Hamoir gives a detailed review of the properties of fish proteins, with some illustrative electrophoretic patterns of muscle extracts. Muscle proteins are emphasized, and comparative aspects are discussed. Shewan gives an extensive review of the chemistry and metabolism of nitrogenous extractives in fish. The possible role of trimethylamine oxide is discussed, and data are given on the seasonal variation of this in herring and brisling. Data are also given on the content of imidazole derivatives, of urea, and of various bases in different species. The section on the volatile bases in staling fish (i.e., in fish kept on ice for up to 30 days) is startling. As shown by Cutting in a subsequent paper, the preservation of the catch is becoming an increasingly important economic problem. This is because of the depletion of the old fishing grounds and the inadequate refrigeration available on most fishing vessels, which must now make longer and longer journeys. More rigid control of the total catch in any given area and better means of preservation are essential. In another contribution, the chemistry and metabolism of fats is discussed by Lovern. Carotenoids are reviewed by Goodwin, not only with respect to their distribution in different species but also with respect to their formation, their role in pigmentation, photoresponses, and reproduction, and their function as a source of vitamin A. There is also a brief article by Haslewood on the bile salts of fish.

This symposium will be of interest to biochemists and to biologists generally. It will probably drive more readers to the rod and reel than to the fish market.

F. CHINARD

MODERN TRENDS IN PHYSIOLOGY AND BIOCHEMISTRY. *Woods Hole Lectures Dedicated to the Memory of Leonor Michaelis.*

Edited by E. S. Guzman Barron. Academic Press, New York. $8.50. xxii + 538 pp. + 1 pl.; ill. 1952.

This is a series of lectures given by a group of outstanding scientists as a part of the 1950 Physiology course of the Woods Hole Marine Laboratory. The volume is dedicated to the memory of L. Michaelis, whose work, together with that of Jacques Loeb and S. P. L. Sörensen, has had such a decisive influence in introducing the physicochemical approach to biological phenomena. In the memorial lecture with which the course is opened, Guzman Barron tells us about Michaelis' life, his intellectual stature, and his gift of translating the most complex phenomena into sim-

ple principles and of expressing them with admirable clarity.

Of the 20 following chapters, 5 are devoted to the structure and physiology of the cytoplasm and the nucleus, including the problems of cell division and cell permeability. In another group of lectures, several aspects of enzyme reactions are discussed, such as the enzyme-substrate combination, the formation of metal-protein complexes, and the relation between the chemical and physicochemical properties of chymotrypsin and the specificity of its action. The changes in the ultrastructure of nerve fibers and the electrical and chemical phenomena which accompany the transmission of the impulse in the nerve and at the nerve-muscle junction are described in 4 other chapters. A group of lectures deals with the thermodynamics of muscle contraction, the properties of the contractile proteins, and the permeability of muscle and nerve to sodium and potassium. Several other subjects, such as the mechanism of biological oxidations, the oxidative pathways of carbohydrates, the mechanism of drug action, and the comparative aspects of various biochemical and physiological processes are treated in the remaining chapters.

As pointed out by Guzman Barron, in all of these lectures biological problems are visualized essentially from chemical and physicochemical viewpoints. This gives a substantial unity to the book, in spite of the variety of the subjects and the multiple authorship. Because of the accuracy and completeness of the information, as well as because of the thought-provoking manner in which this information is presented, the reading of this volume should prove to be thoroughly enjoyable and highly profitable to students and investigators of the biological sciences.

CAMILLE ARTOM

LABORATORY INSTRUCTIONS IN BIOCHEMISTRY. *3rd Edition.*

By Israel S. Kleiner and Louis B. Dotti. C. V. Mosby Co., St. Louis. $3.25 (paper). 280 pp. 1951.

This is a manual of detailed instructions for an elementary laboratory course in biochemical procedures. This third edition has been revised to include a discussion of photoelectric colorimetry, as well as a group of nutrition experiments.

CHEMICAL THERMODYNAMICS. *Basic Theory and Methods.*

By Irving M. Klotz; with advice and suggestions from Thomas Fraser Young. Prentice-Hall, New York, $6.00. xiv +369 pp. 1950.

This is a succinct and well organized introductory textbook of classical thermodynamics, designed primarily for chemists. The approach is phenomenological, entirely excluding the statistical viewpoint, since the author feels that an effective presentation of statistical theory should be independent and complementary to phenomenological thermodynamics. However, there are occasional asides in which intriguing applications of the statistical methods are mentioned. The author aims to stress the "operational" approach to abstract concepts, and feels that this treatment "makes some contribution toward freeing the student from a perpetual yearning for a mechanical analogue for every new concept to which he is introduced."

Klotz pays a great deal of attention to training the student in the application of the theory of thermodynamics to problems encountered by the chemist. Exercises which accompany each chapter have been designed to simulate actual problems more closely than in most textbooks. There are a number of references to more advanced treatises as well as to some experimental reports. An introduction to the mathematical apparatus is well worth its 23 pages. This is followed by 150 pages on basic principles, and 170 pages on systems of variable composition. The latter section gives major emphasis to solutions and includes an explicit and detailed treatment of the activities of solution components which should recommend the book to chemically minded students of biology.

EVELYN HOWARD

LABELLED ATOMS. *The Use of Radioactive and Stable Isotopes in Biology and Medicine. Sigma Introduction to Science 18.*

By Raymond Glascock; line drawings by Doris E. Jones. Interscience Publishers, New York and London. $1.25. 227 pp. + 8 pl. 1951.

So many "simple" books have been written about radioactivity in the past few years, that another one should deserve mere mention without comment. This small book, however, seems worthy of more note, in that, aside from being an introduction to labelled compounds, the emphasis is placed on biological material, and the techniques used are clearly explained. The author has tried to draw illustrative material from as many different sources as possible, and, in some cases, at least, has attempted to evaluate it critically. All in all, this is a very informative little book, and one well worth having on a general reading shelf.

C. P. SWANSON

THE BIOCHEMISTRY OF FERTILIZATION AND THE GAMETES. *Biochemical Society Symposia No. 7. A Symposium held at The London School of Hygiene and Tropical Medicine on February 17, 1951.*

Organized and edited by R. T. Williams. Cambridge University Press: London and New York. 9s. 6d.; $2.25 (paper). vi + 66 pp.; ill. 1951.

Aside from a brief introduction and a short summary, this publication consists of the following critical discussions and reviews: Fertilization in Vitro of the Mammalian Egg (A. U. Smith); Mammalian Semen; Composition, Metabolism, and Survival (T. Mann); Hormonal and Nutritional Factors in the Metabolism of the Male Accessory Organs of Reproduction (C. Lutwak-Mann); Hyaluronidase and Fertilization (Lord Rothschild); and Biochemistry of Sexual Reproduction in Plants (L. E. Hawker). Each paper is followed by a bibliography. Those interested in the field will find this publication to be of great value.

WALTER C. TOBIE

MICRO-ANALYSIS IN MEDICAL BIOCHEMISTRY. *2nd Edition.*

By E. J. King. Grune & Stratton, New York. $3.50. viii + 222 pp.; ill. 1951.

Since the first edition in 1946, this little manual has been modified and somewhat enlarged. It deals with the collection and biochemical investigation of blood, urine, etc., with tests of function, preparation of volumetric solutions, and those techniques of colorimetry and photometry which are somewhat special to biochemical practice. New material introduced includes: ketosteroids, formaldehyde-stable acid phosphatase, the insulin plus glucose test, effective renal plasma flow and glomerular filtration rate, fat balance, and several new or modified analytical methods. The book is intended as a book to be used in the laboratory, rather than a textbook to read.

EXPOSÉS ANNUELS DE BIOCHIMIE MÉDICALE *Publiés sous la Direction de Michel Polonovski. Dixième Série.*

By A. Aschkenasy, P. Boulanger, E. Chain, P. Fouché, A. Horeau, B.-P. Jansen, H.-A. Krebs, J. Lavollay, A. Lespagnol, J. Neumann, J. Roche, and F. Tayau. Masson & Cie., Paris. 1500 fr. (paper). 389 pp.; ill. 1949.

The ninth volume of this useful series continues in the general vein of its predecessors. The articles are not annotated bibliographies but rather are general reviews of the development, of the methods and results, and of the significance to biochemistry and medicine of selected fields of research.

In the first article, Chain reports on studies on the structure, properties, and attempts at synthesis of the penicillins. The next article, by Krebs, is a descriptive review of the tricarboxylic acid cycle. It is practically identical with that author's recent Harvey Lecture. Roche gives a very thorough discussion of arginase and of other enzymes that catalyze the hydrolysis of substituted guanidines. Other articles of general biochemical interest are on the intermediary metabolism of amino acids (Boulanger) and on biochemical genetics (Fouché). The extensive reviews by Tayeau on the biochemistry of bile salts and by Aschkenasy on biochemical aspects of the formation of erythrocytes and leucocytes place greater emphasis on clinical matters. There is a short article on synthetic estrogens by Horeau and one by Lespagnol on the chemical methods and hypotheses used in deducing the structure of complex organic molecules occurring in nature. Finally, Lavollay and Neumann have reviewed the possible significance of various organic compounds to capillary fragility.

F. CHINARD

EXPOSÉS ANNUELS DE BIOCHIMIE MÉDICALE. *Onzième Série.*

By MM. P. Boulanger, G. Biserte, A. Fleisch, A. Gajdos, M.-F. Jayle, F. Kögl, L. Massart, K.-H. Meyer, M. Polonovski, P. Putzeys, G. Schapira. Edited by Michel Polonovski. Masson & Cie., Paris. 1100 fr. (paper). 272 pp. 1950.

In this eleventh volume of this series there are a number of reviews of general interest to biologists and biochemists. The article on the application of light-scattering to the study of proteins by Putzeys, one of the early pioneers in the field, is a brief survey which may well serve as an introduction to the more complex treatments available in English. Boulanger and Biserte present an exhaustive review on partition chromatography, and treat both the theoretical aspects and the applications of chromatography on silica and on starch columns and on filter paper. The separation and identification of amino acids, peptides, sugars, and of constituents of nucleic acids are discussed; there is an extensive bibliography. An article by Kogl reviews his work on D-glutamic acid and reports on the isolation of D-pyrrolidone carboxylic acid from the urine of rats fed the protein fraction of tumors caused by benzpyrene. Other articles are on amylases, phosphorylases, and the synthesis and degradation of starch (K. H. Meyer), the biochemistry of the acridines (Massart), the excertion of gonadotropins and steroids in pregnancy (Jayle), serum esterase (Gajdos), the biochemistry of shock (Schapira), and pterines (Polonovski).

F. CHINARD

THE ABC OF ACID-BASE CHEMISTRY. *The Elements of Physiological Blood-Gas Chemistry for Medical Students and Physicians. 3rd Edition.*

By Horace W. Davenport. University of Chicago

Press, Chicago. $2.00 (paper). viii + 86 pp.; ill. 1950.

Among the more difficult problems of clinical medicine are those pertaining to disorders of electrolytes and the acid-base balance. The difficulties arise in part from the still inadequate understanding of fundamental physiological and chemical processes, in part from the technical problems involved in obtaining adequate data to which current knowledge can be applied, and not in least part from inadequacies in the training of physicians. The subject matter is admittedly painful to the first-year medical student. It is also painful to the instructor who must present the material in such a manner that the student will retain the essentials through medical school and through the subsequent years of hospital training and practice.

There are many ways in which the presentation can be made. One is to take advantage of the advances of physical chemistry, protein chemistry, and thermodynamics, and to build logically on a firm foundation. Knowledge and understanding so gained by the student should be applicable to new problems as they arise. This approach makes a break not only with traditional clinical terminology and concepts, but also with the traditional presentation found in nearly every textbook of biochemistry. Another way is to continue in the well-worn tracks of the past and to express, as best as possible, the current advances in the inadequate and often confusing language of 30 years ago. It is unfortunate that in this third edition of his book Davenport has continued to follow the latter course. There is no question about the author's effort to present the material simply and clearly. But, as stated in the Introduction, the chemical terminology the author uses is outmoded; it is "the terminology the students will probably hear all their working lives." Not only is the terminology outmoded; there is also lack of adequate definition of terms, confusion of concept, and inadequacy of content. A few specific examples follow.

In the section on the carriage of oxygen in the blood reference is made to the "diffusion gradient" of oxygen. What is meant is the gradient of the concentration, gradient of the partial pressure, or more precisely gradient of the chemical potential of oxygen. It is stated that ". . the gas diffuses faster the greater the difference in the partial pressure between the two parts of the system." The uninformed student could interpret this to mean that the diffusion coefficient is proportional to the partial pressure difference. It would be less ambiguous to state that the *amount* of gas diffusing is greater the greater the difference of the partial pressures. The description of the properties and structure of hemoglobin is grossly inadequate. No reasons are given for the sigmoid shape of the oxyhemoglobin dissociation curve. No mention is made of myoglobin. No mention is made of carbon monoxide. pH is admittedly not defined. In the discussion of the titration curve of hemoglobin, a negative charge is assigned to one of the nitrogen atoms in the imidazole rings in the physiological pH range. The discussion of the so-called chloride shift is confusing and incorrect. On p. 23, one reads that "chloride ions diffuse into erythrocytes as bicarbonate ions diffuse out." On p. 26, Table II shows quite clearly that the net movement of chloride and bicarbonate is in the same direction. This contradiction, to be sure, is not unique to Davenport's book; it occurs without explanation in nearly every textbook of biochemistry. The treatment accorded the Gibbs-Donnan effect is less than adequate. Gibbs is not even mentioned. The outmoded and confusing clinical designations of respiratory and metabolic acidosis and alkalosis, compensated and uncompensated, are preserved. In Fig. 19, the combination of metabolic alkalosis and respiratory acidosis results in a pH within the normal range while the combination of metabolic acidosis and respiratory alkalosis results in a pH above 7.5. The terms "fixed base" and "alkali reserve" are retained.

The numerous original diagrams contain much useful information; however, a number of hours are required to master their significance and their limitations. One major criticism of these diagrams must be made: no idea of the temporal relationships can be gained from the data as plotted. A few diagrams showing plasma pH, partial pressure of CO_2, bicarbonate concentration or CO_2 content, and plasma chloride concentration plotted against time would be invaluable in showing the relative rapidity of adjustments brought about by the lungs and the relative slowness of adjustments brought about by the kidneys under different conditions. Finally, the data available clinically can be much more easily fitted into the form used by Gamble than into the form used here.

In spite of the limitations mentioned above, this book may be of interest to those who teach the subject to medical students. But, for the reasons indicated, it cannot be recommended for use by the medical students themselves.

F. CHINARD

LES GLOBULINES DU SÉRUM SANGUIN. *Médecine et Biologie, Number 3.*

By Pierre Grabar; edited by Marcel Florkin. Editions Desoer, Liège; Masson & Cie., Paris. 80 fr. (paper). 136 pp.; ill. 1947.

This monograph consists of the text of the report presented by the author to the 7th Biochemical Congress at Liège in 1946. It is a very complete review of the work to that date on the methods and results of fractionation (ultracentrifugation, electrophoresis, and fractional precipitation by various agents), on the immunochemistry, on the physical, chemical, and physiological properties, and on the sites and conditions of formation of the serum globulins. There is an extensive

bibliography and a summary of the discussion which followed the presentation of the report.

F. CHINARD

PROTÉIDES ET LIPIDES DANS LE SÉRUM SANGUIN. *Recherches Expérimentales Conclusions Théoriques Applications Pratiques.*

By Francis Tayeau. Imprimerie E. Drouillard, Bordeaux. Out of print (paper). ii + 187 pp.; ill. 1944.

DIE BIOLOGIE DES MAGENKATHEPSINS. *Experimentelle Untersuchungen zur Physiologie und Fermentchemie der Eiweissverdauung im Magen.*

By S. Buchs; foreword by E. Freudenberg. S. Karger, Basel. Swiss fr. 12.—(paper). 82 pp.; ill. 1947.

THE PHOSPHATIDES. *American Chemical Society Monograph Series.*

By Harold Wittcoff. Reinhold Publishing Corporation, New York. $10.00. xviii + 564 pp. 1951.

The Editors of the American Chemical Society Monographs state that the monographs are intended, first, to make available a thorough treatment of a selected area to persons working in other fields, and, second, to stimulate further research in the specific field treated. Wittcoff's book, which is the latest addition to the series, fulfills both purposes perfectly.

Phospholipides are universal constituents of living cells, and evidence is growing that they play almost as important a role as proteins and nucleic acids in determining the essential properties of the living matter. The complexity of their structure and the large number of chemical individuals with similar physical properties make extremely difficult the study of these compounds. Still, substantial progress has been made in the past two decades, and it is covered well in this book. At the same time due credit is given to the earlier contributions, which have made possible the latest advances, including some recent "rediscoveries." The existing uncertainties and numerous gaps in our present knowledge are pointed out clearly, and should represent a challenge to workers in the field.

The structure of the major and minor components of the natural phospholipide mixtures, the methods for their separation and determination, the products of total and partial hydrolysis and the enzymes involved in their production, the distribution and metabolism of phospholipides in animal tissue, as well as the facts and the hypotheses regarding their roles in physiological and pathological conditions are reviewed in logical succession. Wittcoff's language is clear and concise; yet he does not attempt to avoid some repetition, when this seems necessary to make the discussion more readily understood. Separate chapters are devoted to the phospholipides of microorganisms and plants, and to the manufacture and industrial uses of phospholipides. Those investigators, who, like me, have worked chiefly on the biochemistry of phospholipides in animal tissues, will greatly profit from these chapters, where much information has been collected from publications not commonly found in medical or biological libraries.

Because of its excellent features, it may well be expected that Wittcoff's book will have an influence on the development of our knowledge in this field no less important or beneficial than that which has been exerted in years past by other comprehensive reviews, such as those of MacLean and MacLean and of Thierfelder and Klenk.

CAMILLO ARTOM

CONDENSED REVIEW OF PHARMACY *Specially Adapted to College of Pharmacy Students. Seventh Edition.*

By George W. Fiero. John Wiley & Sons, New York; Chapman & Hall, London. $3.25. iv + 122 pp. 1952.

A summary of drugs, chemicals, and preparations for pharmaceutical use. The book is intended for use by the student as a review of his college work prior to taking examinations.

C. JELLEFF CARR

ORGANIC REACTIONS. *Volume VI.*

Editor-in-Chief: Roger Adams. John Wiley & Sons, New York; Chapman & Hall, London. $8.00. viii + 517 pp. 1951.

Once again the editors of *Organic Reactions* have published a book which is of inestimable value to organic chemists. The reactions discussed in Volume 6 of this series are of great general importance, and each chapter is put together in such a way that a large amount of information may be quickly obtained. To anyone who has made use of any of the preceding 5 volumes, we may state that there has been no let-down in overall excellence. More specifically, the reactions dealt with are: (1) The Stobbe Condensation; (2) The Preparation of 3,4-Dihydroisoquinolines and Related Compounds by the Bischler-Napieralski Reaction; (3) The Pictet-Spengler Synthesis of Tetrahydroisoquinolines and Related Compounds; (4) The Synthesis of Isoquinolines by the Pomeranz-Fritsch Reaction; (5) The Oppenauer Oxidation; (6) The Synthesis of Phosphonic and Phosphinic Acids; (7) The Halogen-Metal Interconversion Reaction with Organolithium Compounds; (8) The Preparation of Thiazoles; (9) The Preparation of Thiophenes and Tetrahydrothiophenes; and (10) Reductions by Lithium Aluminum Hydride.

TEXTBOOK OF ORGANIC CHEMISTRY. *Third Edition.* *By George Holmes Richter. John Wiley & Sons, New York; Chapman & Hall, London.* $6.75. viii + 762 pp.; ill. 1952.

This volume is a textbook for beginning students in organic chemistry. The text is comprehensive in scope, with considerable attention given to theories, nomenclature, syntheses, and reactions. The 3rd edition includes much new material concerning the electronic configuration of elements and a consideration of molecular orbitals in reference to the sigma and pi components of double bonds.

Brief discussions of nuclear structure and of isotopes of interest to organic chemistry are also included. In the field of nomenclature, the text includes the newer conventions concerning the naming of sugars and amino acids.

R. VAN REEN

MICROBIOLOGY

RECENT ADVANCES IN THE STUDY OF PLANT VIRUSES. *Second Edition.*

By Kenneth M. Smith. The Blakiston Company, Philadelphia. $4.50. viii + 300 pp. + 20 pl.; text ill. 1951.

In view of the tremendous advances made in the study of plant viruses since 1933, when the first edition of this work appeared, the present revised edition has been radically reorganized. When originally published, this book reflected the main lines of study at the time, namely, the symptomatology of plant virus diseases and the relationships between viruses and their insect vectors. The immense progress which has been made during the last two decades, with especial emphasis on the virus itself, is indicated in the new sections that deal with the isolation and crystallization of several viruses and the biochemical studies which have stemmed from these findings. Accordingly, almost half the book is devoted to such topics as the methods of purification of viruses, the properties of purified viruses, the sizes of viruses and the methods employed in their estimation, electron microscopy, strains, mutations, and variation in viruses, and the very important branch of the serology of plant viruses. In addition, the topics of symptomatology, virus insect-vector relationships, the physiology of diseased plants, and control are treated in a precise and well-ordered manner. The volume is well supplied with illustrations, electron micrographs, and an annotated bibliography, and represents a very useful contribution to the plant scientist's library.

ALVIN NASON

BACTERIAL PHYSIOLOGY.

Edited by C. H. Werkman and P. W. Wilson. Academic Press, New York. $8.50. xiv + 707 pp.; ill. 1951.

This book, to which many authors have contributed, provides a broad current survey of bacterial physiology and biochemistry. The subjects covered are: Chemistry and Structure of the Bacterial Cell (Knaysi); Inheritance, Variation and Adaptation (Lederberg); Bacterial Growth (Gunsalus); Physical Factors Affecting Growth and Death (Mitchell); Chemical Factors Affecting Growth and Death (Wyss); Nutrition (Snell); Bacterial Enzymes (Schlenk); Fermentation of Carbohydrates (Werkman and Schlenk); Bacterial Oxidations (Barron); Autotrophic Assimilation of Carbon Dioxide (Foster); Heterotrophic Assimilation of Carbon Dioxide (Werkman); Organic Nitrogen (Gale); Nitrogen Fixation (Wilson); Mineral Metabolism (Knight); Oxidation of Hydrogen (Koffler and Wilson); Assimilation (Clifton); Degradation and Synthesis of Complex Carbohydrates (Barker and Hassid); Significance of Autotrophy for Comparative Physiology (Umbreit); and Luminous Bacteria (Johnson). The book concludes with an extensive bibliography and indices to subjects and microorganisms.

Regarded as a collection of essays, this is a stimulating and useful book for anyone already grounded in the subject. Most of the chapters are written by experts, and the scientific level is on the whole high. Inevitably, a few sections are disappointing. Among these are the introductory chapters on the chemistry and structure of the bacterial cell, which give a thoroughly distorted account of these subjects, since the author has chosen to ignore much important contemporary work. For example, he makes no mention of Robinow's contributions to bacterial cytology, or of the researches on L-forms by Klieneberger, Dienes, and others. The 30-page terminal essay on the theory of rate processes, which masquerades under the title of "Luminous Bacteria," is of dubious relevance. It might have been replaced with profit by a chapter on enzymatic adaptation, an important aspect of bacterial physiology which is omitted, save for passing mention in the chapter on bacterial enzymes.

Bacterial Physiology was designed to meet the generally recognized need for a suitable textbook. Although much better than any of the other textbooks available, it does not provide a really satisfactory introduction to the subject. Unity of style and outlook are admittedly impossible in a compendium of this kind; but careful initial selection of the material for each chapter, coupled with judicious editing, are essential if such a book is to be used by students. The absence of a strong editorial hand is particularly noticeable in the chapters on metabolism, where the main types of energy-yielding processes are dealt with in such piecemeal fashion

that an uninitiated reader will find it very difficult to abstract the essential features of bacterial oxidations, fermentations, and photosyntheses. Since fermentation is discussed in the chapter on the anaerobic dissimilation of carbohydrates, the many fermentations of other organic compounds—amino-acids, purines, etc.— get scattered and fragmentary treatment elsewhere. Some appear misleadingly in the chapter on oxidative metabolism; others are mentioned in the chapter on organic nitrogen. The bacterial photosyntheses and the processes of sulfate, nitrate, and carbonate reduction crop up in the chapter entitled Autotrophic Assimilation of Carbon Dioxide, although many of the bacteria concerned are typical heterotrophs. The chapter on bacterial oxidation furnishes almost no information about the oxidative breakdown of substrates (apart from an inadequate analysis of terminal respiratory cycles), but devotes several pages to the metabolism of the clostridia. Later on, there is an entire chapter on the oxidation of hydrogen, a minor aspect of oxidative metabolism.

Lastly, the book could have been improved and shortened by drastic literary revision. The depressingly low standards of grammar and composition in many sections reflect no credit on either editors or publishers. Some examples follow: "it is difficult to conciliate such a relationship with the malate thesis, since . . ."; "searching for an answer, the hydrogen bacteria come to mind"; "although offered only as a working hypothesis, in this chapter we may speculate that . . .". Writers who can conciliate a relationship with a thesis, make hydrogen bacteria search for an answer, or offer themselves as a working hypothesis, are capable of worse things. Such minor slips—symptomatic of sloppy thinking—are the forerunners of gobbledygook like this: "The point is, in the past, by this observation it has been implied that autotrophic metabolism is so unique that heterotrophic food is incompatible with it. This is incorrect." Not only incorrect, but well-nigh unintelligible.

R. Y. STANIER

A DICTIONARY OF ANTIBIOSIS.

Compiled by Leonard Karel and Elizabeth Spencer Roach Columbia University Press, New York. $8.50. vi + 373 pp. 1951.

The worker in the field of antibiosis will find this dictionary to be a comprehensive and well-documented reference volume. The references are listed alphabetically, and include plants from which antibiotic substances have been obtained, species used for bioassay studies, and specific antibiotics. Under each antibiotic, information is supplied as to source, extraction methods, properties, and results from biotic tests. The extensive bibliography is given alphabetically, and each citation is given in full. As a result, the volume is an elaborate cross-reference file, useful to the research worker in medicine and biology, and to practicing physician.

PRINCIPLES AND PRACTICE OF BACTERIOLOGY. *Fourth Edition, revised.*

By Arthur H. Bryan and Charles G. Bryan. Barnes & Noble, New York. $1.75 (paper). xvi + 410 pp. + 4 pl.; text ill. 1951.

This book has been considerably modernized since the third edition (see *Q.R.B.*, 26: 314. 1951), which appeared in 1942 and was reprinted in 1950. A brief treatment of antibiotics is now included. Sets of examination questions have been added in an appendix. The bibliographies at the ends of the chapters have been brought up to date. As before, a very large amount of information has been condensed into a small space. The useful quick reference table to standard textbooks has been expanded and is printed in larger type. As a tightly written first approach to bacteriology and related fields, this book can be highly commended.

WALTER C. TOBIE

THE DIFFERENTIATION OF ESCHERICHIA AND KLEBSIELLA TYPES. *Publication No. 84, American Lecture Series.*

By F. Kauffmann. Charles C Thomas, Springfield, Ill. $2.00. x + 57 pp. 1951.

This little treatise will be of great interest to those interested in classifying bacteria of the *Escherichia* and *Klebsiella* genera on the basis of "types" rather than "species." The serological methods used are based on the S-R variation of Arkwright, the O-H variation of Weil and Felix, and the K-O variation of Kauffmann. On his "type" classification basis, Kauffmann considers that the genus *Aerobacter* merges into the genus *Klebsiella*. He makes the point (which will bear repeating) that among the bacteria (at least among the Enterobacteriaceae), no *sharply defined* groups exist, since cultures can always be found that occupy intermediate positions. Serological differentiation on the basis of "types" permits sharper distinctions between different "strains" or "cultures" than classification on the basis of "species" based on morphology and substrates biochemically altered, although the latter method of classification is simpler and quite adequate in many cases. The reviewer takes no stand in favor of either position. It seems reasonable to evaluate the appropriateness of a system of classification by considering the particular situation or problem to which it is applied.

WALTER C. TOBIE

BACTERIAL TOXINS.

By W. E. van Heyningen. Charles C Thomas, Springfield, Ill. $3.50. viii + 133 pp. + 4 pl. 1950.

This excellent monograph is based upon 4 lectures given at University College, London, in November, 1949. As stated in the Preface, "its purpose is to deal more fully with a subject that is treated only briefly in textbooks of pathology and bacteriology and has not yet found its way into textbooks of biochemistry." The author considers that a classification based upon whether the toxins are derived from Gram-negative or Gram-positive organisms is more significant than the conventional classification as endotoxins or exotoxins. Most Gram-negative toxins appear to be polymolecular phospholipid-polysaccharide-protein complexes that produce symptoms which are rather similar, irrespective of the organisms from which they are derived. The Gram-positive toxins appear to be simple proteins, and are much more specific in their effects. The spreading factors, fibrinolysins, and coagulases are also considered. Besides an index of subjects and of authors, there is an excellent bibliography. This book should be of outstanding value to all interested in the field.

WALTER C. TOBIE

MICROBIAL DECOMPOSITION OF CELLULOSE *With Special Reference to Cotton Textiles.*

By R. G. Siu. Reinhold Publishing Corporation, New York. $10.00. xii + 531 pp.; ill. 1951.

This extremely comprehensive treatise on cellulose is divided into 5 parts. The introductory section is concerned with such general aspects of cellulose in nature as its place in the carbon cycle, commercial applications of cellulolytic microorganisms, and the economic significance of cellulose deterioration. This is followed by a detailed discussion of the physical and chemical characteristics of cotton fibers. The third section deals with the numerous microorganisms capable of degrading cellulose. In addition to listing them, it presents elaborate experimental data on their physiological and biochemical characteristics. The remaining portion of the book deals with the biochemical transformations that occur in the degradation of cellulose and with the principles and procedures involved in preventing this degradation. Much of the information presented in this book is based on research with which the author has been personally associated. Very effective and extensive use is made of figures to present experimental data.

The author has accomplished the tremendous task of reviewing and integrating the mass of information pertaining to this subject. For example, the chapter on toxic inhibitors makes reference to 526 publications, and the chapter on causal agents, their morphological and taxonomic aspects, to 433. This extensive bibliography alone represents a very significant contribution. The textile technologist, microbiologist, biochemist, and related groups of scientists will find this volume of considerable value.

MICHAEL J. PELCZAR, JR.

HEALTH AND DISEASE

HEALTH INSTRUCTION YEARBOOK 1950.

Compiled by Oliver E. Byrd; foreword by Jesse Feiring Williams. Stanford University Press, Stanford, Cal.; Geoffrey Cumberlege, Oxford University Press, London. $3.50. x + 270 pp. 1950.

The eighth issue of this annual publication follows the pattern of previous years, giving 255 brief digests of original material which has appeared in journals and other publications in 1949 and 1950. The summaries are written in a clear and interesting style, and cover a very wide range of topics in the fields of health, safety, sanitation, and related subjects. Recent advances in clinical medicine are also considered. The subject and author indexes are adequate. There is a bibliography of 255 references. It would have been helpful to have given the addresses of the authors in fuller detail, so that those interested could more readily write for reprints of original papers. This is a minor flaw. In general, the book can be highly recommended.

WALTER C. TOBIE

ANNUAL REVIEW OF MEDICINE. *Vol. 2.*

Editor: Windsor C. Cutting; Associate Editor: Henry W. Newman. Annual Reviews, Stanford, California. $6.00. x + 485 pp. 1951.

This newest member to the *Annual Review* family should be welcomed by both the practioner and the clinician engaged in medical investigation. In this volume the following topics are reviewed: Infectious Diseases—Viral and Rickettsial Diseases (F. M. Burnet); Diseases of the Gastrointestinal Tract (K. S. Grimson and B. H. Flowe); Diseases of the Cardiovascular System (I. H. Page and A. C. Corcoran); Diseases of the Urinary System (R. M. Nesbit and J. Lapides); Diseases of the Reticuloendothelial System and Hematology—Hemorrhagic and Leukocytic Diseases (C. A. Finch); Nutrition and Nutritional Diseases (A. P. Meiklejon and R. Passmore); Allergy (B. Rose); Diseases of the Reproductive System (W. O. Nelson and C. G. Heller); Diseases of the Nervous System (J. M. Nielsen); Psychiatry (E. Lindemann); Diseases of the Respiratory System (G. W. Wright); Physical Agents and Trauma—Trauma Due to Stress and Physical Agents (A. R. Behnke); Radiology and Radioactivity (L. H. Garland); Laboratory Aids to Diagnosis and Therapy

(J. P. Peters); Diseases of the Skin (J. R. Scholtz and C. Williamson); General-Adaptation-Syndrome (H. Selye); Neoplastic Diseases (J. C. Aub and I. T. Nathanson); Diseases of Bones and Joints (W. C. Kuzell); Annotated List of Reviews in Medicine (E. M. MacKay).

The abbreviation now employed by Hans Selye for the general-adaptation-syndrome is G-A-S.

DAVID B. TYLER

ANNUAL REVIEW OF MEDICINE. *Volume 3.*

By Windsor C. Cutting and Henry W. Newman. Annual Reviews, Stanford, Cal. $6.00. x + 442 pp. 1952.

Subjects reviewed in the present volume are: nutrition; endocrinology; allergy; psychiatry; trauma; radiology; obstetrics; plastic surgery; as well as infectious, gastrointestinal, cardiovascular, urinary, reticuloendothelial hematological, neoplastic, reproductive, nervous, respiratory, bone and joint, and tropical diseases. As usual in the various series of *Annual Reviews*, the treatment is excellent and the indexes are adequate. Each review is followed by a large number of useful references. It is unfortunate that in some (though not in all) of the reviews, the references are listed in the order in which the work of the authors is mentioned in the review. This will cause inconvenience to readers who wish to look up the contributions of a given author, even if they refer to the general Author Index. Listing of authors in alphabetical order following each review would be more logical and convenient.

WALTER C. TOBIE

SCOLIOSIS. *Pathology, Etiology, and Treatment.*

By Samuel Kleinberg. Williams & Wilkins Company, Baltimore. $7.50. xvi + 286 pp.; ill. 1951.

This book on scoliosis is worthy of careful reading by anyone interested in this special subject. For the most part, the author has presented good material in a well-organized, easy-to-read style. The book is extensively illustrated, and care has been taken in arranging the photographs so that each illustration is almost always on the same page as the discussion pertaining to it.

The book is divided into two parts of 6 chapters each. Part I deals with anatomy, embryology, physiology, pathology, etiology, and examination. Part II deals with the various aspects of preventive, conservative, and surgical treatment of scoliosis. There is a common-sense, practical approach to many of the complex problems which must be dealt with in scoliosis, and one is aware that the author really comprehends the many-sided, long-term aspects of this orthopedic disability. One is constantly reminded of the general principles upon which care of the scoliosis patient is based, and at the same time the author gives as many specific details of treatment as it is advisable to outline.

It is my opinion, however, that the chapter on gymnastic exercise is not up to the standard of the rest of the book. While careful x-ray analysis and photographs are considered essential to determining changes of alignment in the spine, the author has failed to recognize the need for careful muscle analysis as the basis on which therapeutic exercises should be selected. An analysis of the 52 exercises described as developmental and corrective shows clearly that little consideration has been given to analyzing the muscle problems in the patient. The gross assumption that the muscles on the concave side are the weak muscles is not a valid one on which to base selection of exercise.

In this chapter on exercise, the photographs very beautifully illustrate the exercise described, but they lose much of their value because the subject is a normal individual with an excellent posture. A few photographs and x-rays of a scoliotic patient in the position of starting and completing corrective exercises would have much more value than the array of photographs shown here. In its lack of scientific approach to the exercise phase of scoliosis work, this book is not unlike many others, but it is regrettable that an otherwise good book has failed in this respect.

HENRY O. KENDALL

MY FIGHT TO CONQUER MULTIPLE SCLEROSIS.

By Hinton D. Jonez as told to Miriam Zeller Gross. Julian Messner, New York. $3.50. 228 pp. + special pamphlet available to recognized medical personnel. 1952.

If this book was published to call attention to multiple sclerosis and to present in a favorable light the work done at the clinic of St. Joseph's Hospital, it accomplishes its objectives well. It was written for Dr. Jonez in a popular style by Miriam Zeller Gross, an experienced writer on medical subjects for lay periodicals. The theme is a simple one. A doctor with an interest in multiple sclerosis starts a clinic for the treatment of patients suffering from this disease and builds it up so that in a 5-year period he has had almost 2000 such patients. Interest is developed by stressing the administrative hurdles, appeal is heightened by reciting many anecdotes about patients, and a climax is attained by reporting success—the breaking of ground for a clinic building. These devices yield a book that is quite readable and that leaves the lay reader with the impression that a "workable treatment" has been developed for multiple sclerosis, as evidenced by the "miracles that began to happen at St. Joseph's Hospital." (The quotations are from the jacket.)

The scientist and the critical physician may look askance at the miracles. They are more likely to accept Dr. Jonez's statements, "We have made no world-

shaking discoveries" and "We take no credit for original work." They may feel that isolated stories do not constitute case reports, and if they are kindly disposed they may hope that a careful study will some day be made of the entire group of cases to determine the value of the recommended procedures.

I. Wm. Nachlas

Disorders of the Blood. *Diagnosis, Pathology, Treatment, Technique. Sixth Edition.*

By Lionel E. H. Whitby and C. J. C. Britton. Blakiston Co., Philadelphia. $8.00. xii + 759 pp. + 12 pl.; text ill. 1950.

The chapters on hemopoietic metabolism, coagulation, the hemolytic anemias, leukemia, hemagglutination, pigment metabolism, and hematological techniques have been revised. Eight-five pages and 4 new plates have been added. The book is a comprehensive and authoritative reference work (5th ed., see *Q.R.B.*, 22: 365. 1947). As a textbook it would have been improved had the authors avoided such duplication as the double discussion of Mediterranean anemia, once in the chapter on The Haemolytic Anemias and again in the chapter on Anemias in Infancy and Childhood. Confusion could be avoided if it were pointed out clearly that erythroblastosis fetalis, fetal hemolytic disease, icterus gravis neonatorum, and congenital anemia without icterus or hydrops are all varieties of maternal-fetal blood group incompatibility, by far the commonest being that due to the Rh factors (see Edith L. Potter, *Rh*, Year Book Publishers, 1947). Although the authors have made a valiant effort to keep abreast of a rapidly increasing body of knowledge, the organization of the book could be improved.

Bentley Glass

Handbook of Cardiology for Nurses. *The Disease The Patient, Modern Concepts of Treatment.*

By Walter Modell; foreword by Edna L. Fritz. Springer Publishing Company, New York. $3.50. x + 346 pp.; ill. 1952.

Purely medical textbooks are generally not particularly suitable for nurses because they give very little consideration to the practical aspects of nursing. On the other hand, many books for nurses are written without adequate medical understanding and without consideration of the fact that the physician bears the full responsibility for the handling of the patient and hence must have his orders followed meticulously. The *Handbook of Cardiology for Nurses* gives a reasonable definition of the role of the nurse in the case of the cardiac patient. This care is based on carrying out the letter and spirit of the doctor's orders, with full consideration for the personal characteristics of the patient. The problems that so frequently arise from changing and divergent medical practices are dealt with firmly and intelligently. The various groups of cardiac diseases are rather fully presented, with a notable lack of dogmatism upon disputed points. Electrocardiography and various laboratory tests are explained in an uncomplicated manner, while technical details of pathology anatomy, bacteriology, and so forth, not necessary for an understanding of the diseases, are entirely omitted. The text can be read by anyone with a good understanding of basic medical terminology and an observant contact with sick persons. The book is admirably conceived, comprises readable and practical information, and can be recommended not only for those practicing nursing but also for well informed lay persons.

E. Converse Peirce, 2nd

Cancer—*Where We Stand.*

By Sidney Russ; Foreword by Lord Horder. Oxford University Press, New York, London, and Toronto. $3.00. xv + 192 pp. + 15 pl. 1950.

A very well written and accurately documented book for the general public on the present state of our knowledge in this field.

David B. Tyler

The Hygiene of the Breasts.

By Clifford F. Dowkontt. Emerson Books, New York. $2.50. 222 pp. + 4 pl.; text ill. 1948.

The author has prepared a treatise to help women have a better understanding of the function and care of the breasts. He calls attention to the improvements of breasts which might be expected from medical care, exercises, and control of personal habits. The author also indicates how the woman can drape her breasts to emphasize them as ornaments of beauty. All information is given in nontechnical terms. The text is illustrated, primarily by the use of drawings. A glossary is included.

A brief discussion is given of the changes in custom and fashion which have had an effect upon man's appreciation for and woman's display of the breast. The fashion has varied from purposeful elongation for usefulness in nursing, through the use of clothing to hide breasts from view and yet mark off the natural body lines, to the practice of suppressing completely any evidence of breasts.

The ideal body form is defined. The author presents information on the anatomy and physiology of the breast. Most of the book is concerned with the hygiene and care of the breast from infancy to middle adult life, including the special needs during pregnancy and lactation. Diet with its relationship to general health and breast growth is emphasized.

The author explains what a woman can do to make the most of her figure in the development of physical beauty. She must exercise to correct her posture and develop a good carriage, take special exercises to develop her bosom, and watch her personal habits. The essential exercises are described and illustrated. The reader will also find full details on the proper garments to be worn for support and cover of the breasts, and for supplementing the bosom loveliness.

As an ending, the author reminds woman of her enviable position today, due to the fact that our knowledge about the care of health and beauty is advancing. He states: "Having thrown off the shackles of ignorance and superstition and released herself from the tortures of fashion, the woman of today may well challenge those of ancient Greece in their glorious worship of the ideals of health and beauty. The 20th Century may yet be called the age of true and complete freedom for her soul and lovely beauty for her bosom." One cannot help but wonder what fickle fashion may change our modern concept of beauty.

The book may appeal to women. It is probable that few men will be attracted to the work for reading purposes. Males may be affected by some of the effects of the book.

CLARENCE P. OLIVER

POLINOSIS. *Estudio Clinico y Botanico.*

By Plutarco Naranjo Vargas and Enriqueta Banda de Naranjo. Published by the Authors, Casilla 838, Quito, Ecuador (Imprenta de la Universidad Central). $2.00 (paper). 220 pp.; ill. 1950.

Based upon their studies of pollen allergy in Ecuador, the authors have written a volume (in Spanish) which is of importance especially to those who are practicing clinical allergy and who are in search of information and knowledge regarding pollinosis in the countries of South America. This volume, concise yet comprehensive, is divided into two main parts, the first of which deals with the general principles of allergic conditions. A classification of the various clinical allergic disorders is given, with a special discussion of hay fever itself and of bronchial asthma. Etiologic factors, diagnostic procedures, and the various modes of treatment are discussed.

The second part of the volume is important, since it is concerned with many types of pollen-bearing plants which are known to produce hay fever in Ecuador. The authors divide their country into 5 different zones, depending upon the geographic and climatologic features involved, and discuss the hay-fever-producing plants flourishing in each zone. There is a chapter upon the hay-fever-producing plants of the Americas, the list including not only those of North America, but also those of the South American countries, Ecuador, Mexico, Puerto Rico, Cuba, Argentina, Brazil, Peru, Venezuela, Colombia, and Uruguay. The authors are to be congratulated upon the completeness of their work and upon the great amount of information which they have gathered in this small volume. It should be in the reference library of everyone interested in allergic phenomena.

W. C. SPAIN

BACTERIAL AND VIRUS DISEASES: *Antisera, Toxoids, Vaccines and Tuberculins in Prophylaxis and Treatment.*

H. J. Parish. The Williams & Wilkins Company, Baltimore. $2.50. viii + 204 pp. + 8 pl.; ill. 1951.

The first edition of this book (1948) was reviewed in *Q.R.B.* 26: 441. 1951. The comments made in that review still apply in large measure to the present edition, which is still a handbook whose rather limited scope is best indicated by the subtitle. Most of the material is from British sources, but some attention is given to American procedures. The general impression is one of a rather poorly edited work. Some of the figures are numbered, some are designated by letter, while most have no serial designation. The book cannot be regarded as in any way outstanding.

WALTER C. TOBIE

THE BATTLE FOR MENTAL HEALTH.

By James Clark Moloney. Philosophical Library, New York. $3.50. xii + 105 pp. 1952.

This short book is an attempt to convince the public that permissive child care, as taught by the Cornelian Corner of Detroit, is essential to the mental well-being of the future citizens of the world and that its neglect is responsible for much of the mental and social disorganization to be observed at present. The essentials of permissive child care include breast feeding where possible, "rooming in" of newborns with their mothers immediately after delivery, "natural" childbirth, self-demand scheduling for feeding, and, in general, a warm and relaxed attitude on the part of the mother. Certain aspects of American life are considered to militate against these desirable aims, principally competitive and uselessly prolonged and exaggerated traditions of asepsis and "scientific attitude" in physicians.

To press the need for change in life patterns, Moloney marshalls statistics to show that mental illness and social disorganization are rapidly increasing. This is a conclusion that careful statisticians have not reached, and it is unfortunate that this very questionable interpretation is made to bolster the argument in the book.

The argument in favor of permissive child care is based largely on anthropological findings, which are briefly discussed. To the scientist such data are highly suggestive and stimulating and may well be the basis

for action in a society, though they cannot at the present time reach the level of scientific certainty the author attributes to them. I find myself in the position of liking the argument, but saddened that Moloney appears to have attempted to rub off some of the spurious accuracy of his statistics onto the conclusions from anthropological data, which he would like to be more conclusive than a dispassionate perusal shows them to be. The author is thoroughly aroused because the methods and attitudes he proposes for child care are sometimes opposed by others who see things differently. The passion can be appreciated as real and genuine and the author's concepts as basically correct, yet it seems too bad that it carries the author to almost paranoid language in this section and to the warping of the interpretation of data mentioned above.

Scientific writing for the public should, above all, be accurate and unbiased. If data are to be used as scientific proof, the public deserves less passion and more objectivity than is presented here. One does not object to a scientist in any field having deep convictions and attempting to get others to agree with him, but to subvert data to this end is certainly not palatable to brother scientists and is not fair to the public, which is unprepared to make the analyses necessary to uncover the subversion.

PAUL V. LEMKAU

GESTALT THERAPY. *Excitement and Growth in the Human Personality.*

By Frederick S. Perls, Ralph F. Hefferline, and Paul Goodman. Julian Messner, New York. $6.50. xiii + 466 pp. 1951.

This book is an attempt to develop a comprehensive theory of personaltiy and a psychotherapeutic method based on the principles of Gestalt psychology. It succeeds only indifferently. The authors show themselves to possess considerable understanding of human nature and its vagaries, mature widsom, tolerance for other viewpoints, and a detached attitude toward their own. These virtues are conspicuously lacking in many treatises on psychotherapy or personality theory, and deserve the reader's gratitude. On the other hand, the presentation is largely formless (there is not even an index), the conceptualizations often loose, and most of the points are simply rephrasings of widely accepted tenets based on experience and not particularly related to Gestalt theory.

Part of the difficulty may be that most of the really precise conceptualizations of Gestalt psychology developed out of studies of perception, and apply primarily to that field. Although the presentation makes much of such well-defined concepts as "figure-ground," their applicability to personality is often hard to follow. For example, a major concept, the "self," is defined as "the figure/background process in contact situations—where there is most conflict, contact and figure/background there is most self; where there is 'confluence' (flowing together) isolation or equilibrium there is diminished self" (p. 374).

The book falls into 2 almost completely independent parts. The first is essentially a handbook of systematic meditation. It is written in a chatty style, referring to the reader as "you," and consists of a series of "exercises" intended to sharpen and deepen self-awareness as a means of improving mental health. The authors recognize that those who would benefit most from such procedures are least able to carry them out because of the anxiety they arouse. They assume that the reader can do them by himself because their students did so. They apparently fail to see that the instructor acted as therapist in this situation in that he set tasks, assuaged anxiety, and absorbed hostility.

The second part of the book, entirely different in style, is a cloudy, discursive, and repetitive essay on human nature, roaming over such matters as "the structure of growth," "reality, emergency, and evaluation," and the like. There are some excellent passages, as for example a discussion of aggression as a part of normal assimilation and growth, and a consideration of neurotic mechanisms as essentially healthy adaptive functions which are used *instead of* rather than *along with* other functions. There are also cogent and fair critiques of certain psychoanalytical concepts. However, these nuggets are rather widely scattered.

Psychiatry today suffers from a plethora of over-all conceptualizations of human functioning linked to psychotherapies. This treatise is another such effort, not without merit, but not sufficiently well organized or penetrating to rank as of first importance.

JEROME D. FRANK

BRAIN AND PERSONALITY. *Studies in Psychological Aspects of Cerebral Neuropathology and the Neuropsychiatric Aspects of the Motility of Schizophrenics. Second Printing.*

By Paul Schilder. International Universities Press, New York. $2.50. 136 pp. 1951.

This is a welcome second printing of some of the lectures which Schilder gave in Washington to the Washington Psychoanalytic Group, and others to the staff of the Phipps Psychiatric Clinic during the years 1928 and 1930. It was the reviewer's privilege to hear most of these lectures, and he preserves a clear memory of the deep impression made by Schilder because of his remarkable and fascinating way of combining real erudition in the fields of philosophy, psychology, psychiatry, and clinical neurology and neuropathology. Nowhere will one find a better statement of the functional factors in clinical neurology or of the organic substratum of the behavior of the so-called psychoses and psychoneuroses. Every page of this book bristles

with challenges to further inquiry, a product of Schilder's remarkable capacity for observation, for fine detail of performance, and for association with the material from other related fields. It must be added that in the years since, not a great deal of significant advance has been made in the further elucidation of these problems; but even a casual reading of these lectures cannot fail to stir the reader to a more imaginative outlook on the possibilities of interpretation and understanding and of the integration of items from various disciplines. What looked, to the young trainee in psychiatry in that day, like only odd, disparate bits of information concerning the mental states of catatonics and their motility, became under Schilder's genius a thrilling topic for observation, further study, and effort at hypothetical explanation. He had real genius in this field, a wonderful constructive imagination, which seems to be lacking in the current lecture since he is no longer with us. This second printing of his lectures is very much to be welcomed.

WENDELL MUNCIE

PSYCHOLOGY AND ANIMAL BEHAVIOR

VIE ET MOEURS DES MOLLUSQUES.
By P.-H. Fischer. Payot, Paris. 1,200 fr. (paper). 312 pp.; ill. 1950.

No one is better qualified to write a book dealing with the bionomics of the Mollusca than the author of this work, who comes from a family that has been famous in the malacological world for more than a century. Those who expect much from his pen will not be disappointed. Fischer has not attempted to capitalize the reputation of his forebears, but instead has produced a masterpiece to which both his ancestry and posterity may well point with pride. In fact, if the book had been published in the United States in an English translation, surely it would have become the scientific book of the year.

The author is a student of psychology, who begins his discourse with a pertinent question: if man's physical body is the culmination of a long process of organic evolution, why is it not probable that his intelligence is likewise the climax of a parallel process of psychic evolution? If so, psychology should be a comparative science, and should properly begin with the study of the mental processes of lower animals under experimentally controlled conditions. A considerable amount of such experimental investigation has already been done on the vertebrates, and to a less degree on the arthropods, but studies of molluscan psychology are practically non-existent.

The reason for this, Fischer believes, is to be found in the structure of the molluscan integument. Molluscs require a great deal of moisture for their physical well-being, but when under observation so much moisture is lost through evaporation that freedom of action is greatly impeded. In other words, the terrestrial mollusc when observed under experimental conditions is a frustrated personality. His expression of free will is interfered with, so that his reactions to stimuli appear to be automatic. Yet the author believes that the mollusc is capable of exercising a fairly wide degree of choice, and that its mental properties are more complex than is generally realized. For instance, the shell of the limpet is perfectly adjusted to the irregularities of the surface of the rock upon which it resides. But the limpet forages over a fairly wide territory in search of nourishment, and when finished foraging returns home. It is difficult to believe that this diurnal return is not dependent upon some sort of cerebration, and this is also the case in the action of the octopus, which inserts a pebble between the valves of the clam upon which it is feeding to obstruct their closure.

The secretion of the molluscan shell is not a voluntary act, but is analogous to the growth of our own finger-nails. But the removal of the upper whorls by snails of the genus *Rumina* seems to be a case of deliberate conscious amputation. Also, snails of the genus *Xenophora* practice camouflage by attaching foreign objects to their shells. The selection of these appears to be not fortuitous, but the result of conscious deliberation. Some individuals prefer pebbles and use nothing else; others utilize only the dead shells of other molluscs. The arrangement of the latter is not haphazard; clam shells, for example, are always attached with their convex surfaces downward, while gastropod shells are attached in radial position with their apices directed outwardly.

It is obviously true, as the behaviorists have pointed out, that the only way in which knowledge of the mental processes of animals other than man can be acquired is by observation of their behavior. But it is equally obvious that much, if not most, of the behavior of organisms is purely reflex, and has no psychological significance. A knowledge of physiology is therefore a prerequisite for the discrimination between these two kinds of behavior. The author has assembled in this book a greater quantity of data concerned with molluscan physiology and anatomy than the reviewers can recall having encountered between the covers of a single book; actually only 33 out of 312 pages in the present work are devoted to the discussion of pure theoretic psychology. These pages, however, constitute the climax of this work, and to them the discussion of anatomy, physiology, and laboratory technique serve as a preface. The real significance of the book lies in the influence which it may have in the future on the study of animal psychology.

ELISEO JESÚS CORAJE & JOSHUA L. BAILY, JR.

LIFE-HISTORY STUDIES OF EAST AFRICAN ACHATINA SNAILS. *Bull. Mus. comp. Zool., Harvard, Vol. 105, No. 3.*

By Francis X. Williams. Museum of Comparative Zoology, Harvard College, Cambridge, Mass. $1.25 (paper). Pp. 293–317 + 5 pl. 1951.

This work reports an investigation in economic zoology precipitated by the threatened entry into the United States of a species of *Achatina* which has already become a pest in some of the lands into which it has been introduced. The author spent some time in Africa, the native habitat of these snails, studying their natural enemies.

The danger of disturbing the balance of nature by introducing foreign organisms which are able to multiply practically without limit in the absence of all natural control is obvious. We need recall only the European Garden Snail, *Helix aspersa*, introduced some years ago, which has become a pest wherever it has gotten a foothold. But the absence of natural enemies is only one factor contributing to its establishment. Another factor, much more subtle in its operation, is involved. A species when in its natural habitat becomes, in the course of its evolution, adjusted to its natural environment. The changes brought about by the activity of man take place too rapidly for the organism to make the necessary adjustment, and it must retire into the uncultivated areas. When an organism is introduced into a remote region, such as a foreign country, for example, it is likely to find the natural and cultivated environments equally strange. Actually, since so many of the cultivated plants in our gardens came from the Old World, it may well be that an imported organism may find the areas under cultivation more congenial than those in the wild state. The Achatinidae apparently have never reached the status of a pest in their native Africa, but possibly might do so in America.

The introduction of natural controls should be made only under the most careful supervision, if at all. The remedy might easily become worse than the disease, as has been the case with the mongoose in Jamaica. Incidentally, the mongoose is one of the enemies of *Achatina* in Africa, as is also a species of land crab, several carnivorous terrestrial gastropods, and the larvae of some Coleoptera and Diptera.

Some similar organisms are already established in the United States and conceivably might be enlisted in a war against *Achatina*. An investigation of this sort throws light on the resources of our nation in the event of an invasion. I consider this contingency very unlikely. *Achatina* requires a warm and damp climate. Puget Sound is damp enough but not warm enough. San Diego is warm enough but not damp enough. Only the Mississippi delta and the Everglades meet both requirements, and neither is of easy access from the Pacific coast. Yet, eternal vigilance is the price of many things other than liberty.

JOSHUA L. BAILY, JR.

METHODOLOGY AND TECHNIQUES FOR THE STUDY OF ANIMAL SOCIETIES. *Ann. N. Y. Acad. Sci., Vol. 51, Art. 6. November 7, 1950.*

Edited by Roy Waldo Miner; associate editor, B. J. Henegan; consulting editor and conference chairman, J. P. Scott. The New York Academy of Sciences, New York. $2.50 (paper). Pp. 1001–1122; ill. 1950.

The contents are papers given at a conference held jointly by the Section of Biology of the New York Academy of Sciences and the New York Zoological Society in November, 1948. After a Foreword by J. P. Scott, the papers are as follows: General Plans and Methodology for Field Studies of the Naturalistic Behavior of Animals (C. R. Carpenter); The Social Behavior of Dogs and Wolves: An Illustration of Sociobiological Systematics (J. P. Scott); The Relationship Between Observation and Experimentation in the Field Study of Behavior (T. C. Schneirla); Measurement of Some Physiological Reactions to Arctic Conditions (Laurence Irving); Instruments for the Measurement of Physiological Reactions of Unrestrained Animals (J. L. Fuller); Effects of Nutrition and Disease on Experimental Animals (Leonard J. Goss); A Study of the Phylogenetic or Comparative Behavior of Three Species of Grouse (John W. Scott); Social Life and the Individual among Vertebrate Animals (N. E. Collias); The Isolation of Factors of Learning and Native Behavior in Field and Laboratory Studies (Bernard F. Riess); Techniques for Observing Bird Behavior under Natural Conditions (John T. Emlen); The Study of Wild Animals under Controlled Conditions (John B. Calhoun).

The collected papers are intended as a general introduction to the study of sociobiology and animal behavior, and in part, for use as a handbook for younger workers. On the whole, they emphasize a desirable balance between field and laboratory methods.

PAUL L. ERRINGTON

KING SOLOMON'S RING. *New Light on Animal Ways. By Konrad Z. Lorenz; illustrated by the author and with a foreword by Julian Huxley. Thomas Y. Crowell Company, New York.* $3.50. xxii + 202 pp.; ill. 1952.

The study of animal behavior, or ethology, as it is often called, has undergone great expansion in the past few years, particularly as regards work with wild animals living under more or less natural conditions. The

outstanding individual in this new approach to comparative animal behavior has been Konrad Lorenz of Austria. His imaginative and penetrating studies have produced a whole series of new concepts and theories, such as the concepts of "imprinting" and of the "companion" in bird behavior. To be sure, laboratory psychologists have looked askance at certain parts of Lorenz's work. They believe that in some cases his analysis has not in all cases extended to the basic units of behavior. Perhaps not. But the fact remains that Lorenzs' research has invigorated and revolutionized this field of science, and if, as in any bold pioneering work, there are some loose ends to be picked up, well, that is inevitable.

King Solomon's Ring, excellently translated by Marjorie K. Wilson, proves Lorenz to be a writer of rare charm and culture. Its purpose is not to popularize his scientific work, though a few of the chapters do accomplish this, but rather to share with others the experiences of a life-time of observing and working with animals. Some of the chapter headings make this clear: Animals as a Nuisance; Poor Fish; Laughing at Animals; Buying Animals; and The Taming of the Shrew. This is a book that has been very well received by the literary public, and is regarded as one of the better non-fiction works of the year. Anyone interested in animals will find it delightful and instructive.

DEAN AMADON

HUMAN ABILITY. *A continuation of The Abilities of Man.*

By C. Spearman and Ll. Wynn Jones. The Macmillan Company, New York (printed in Great Britain). $2.50. xiii + 198 pp. 1950.

Essentially a sequal to his earlier book, *The Abilities of Man, Human Ability* contains Spearman's later thinking and work on the nature and dimensions of human ability. The concept of Q is evaluated in terms of recent criticism and evidence, and in addition the evidence for other factors of mental ability is brought together and evaluated. The book contains much valuable material on intelligence, sensory motor ability, fatigue, perseveration, speed, memory, and fluency, as well as a number of other topics.

C. W. ERIKSEN

GREAT EXPERIMENTS IN PSYCHOLOGY. *Third Edition. By Henry E. Garrett. Appleton-Century-Crofts, New York.* $3.50. xx + 358 pp. + 15 pl.; text ill. 1951.

Like the two earlier editions, the new edition of this textbook organizes considerable experimental material around a few selected, prominent men in the history of psychology. Emphasizing as it does the role of the real human being as experimenter, this method has for 20 years furnished a very valuable supplement to the conventional introductory textbook.

The principal change has been the addition of a 19-page chapter entitled: McDougall and Social Psychology. As the choice of the key figure implies, this represents more the repair of an earlier oversight than the report of experiments postdating the publication of the second edition. The chapter on personality has been expanded by some 5 pages, half of them devoted to a summary of Freudian theory.

In spite of a wholesale reshuffling of the order of the chapters and the occasional insertion of a new heading (without necessarily a new section), the written material remains virtually unaltered. It is only fair to note, however, that of the 14 "Great Experimenters" featured in 1941, only Ebbinghaus has to content himself with the same old portrait.

FRANK W. FINGER

RECENT EXPERIMENTS IN PSYCHOLOGY. *New Second Edition. McGraw-Hill Publications in Psychology. By Leland W. Crafts, Theodore C. Schneirla, Elsa E. Robinson, and Ralph W. Gilbert. McGraw-Hill Book Co., New York, Toronto, and London.* $3.50. xviii + 503 pp.; ill. 1950.

Primarily designed as a supplement for introductory and beginning courses in experimental psychology, this book contains simplified accounts of representative experiments in the various areas of general psychology. In this revised edition, the experiments have been brought up to date and an increased emphasis has been given to current experiments on perceptual problems, personality dynamics, and social psychology.

C. W. ERIKSEN

PSYCHOLOGICAL THEORY. *Contemporary Readings. Arranged and edited by Melvin H. Marx. The Macmillan Company, New York.* $5.00. xii + 585 pp.; ill. 1951.

This book is a collection of previously published papers written by well-known psychological theorists, and bearing upon the nature of theory construction in psychology. The first part of the book is concerned with the nature and role of theory in psychology. In it are articles dealing with such topics as operationism, the role of constructs, level of description, and theory of measurement. The second part of the book contains articles which illustrate theory construction and application in the fields of perception, learning, psychodynamics, personality, and social interaction.

C. W. ERIKSEN

LEARNING THEORY AND PERSONALITY DYNAMICS. *Selected Papers.*

By O. Hobart Mowrer. Ronald Press, New York. $7.50. xviii + 776 pp. + 6 pl.; text ill. 1950.

This book should more exactly be entitled "Collected Papers on Learning Theory and Personality Dynamics," since it is in fact a collection of theoretical and experimental papers authored or coauthored by Mowrer on the subjects: fear as a learned drive, the two-factor learning theory, and the relation of these to personality theory. Nearly all of these papers have appeared previously in various journals over the last 15 years. In the present book an attempt is made to integrate these numerous and diverse articles into some semblance of a coherent unity by means of short introductory paragraphs and a liberal use of footnotes. The result is a tedious, repetitious, and very uneven book. The experimental papers have been republished in toto, with the result that there is an abundance of procedural detail. Also, there has been little or no attempt to evaluate and supplement these older experiments with current theory and experimental data. Many of the papers had originally been prepared for widely differing audiences, from professional colleagues to laymen. As a result, the difficulty of the subject matter is grossly uneven.

One can see little justification for this book. Mowrer has made many valuable experimental and theoretical contributions in the fields of learning and personality. It is regrettable that he did not see fit to digest his knowledge and experience in these fields into an integrated, well-organized contribution to this topic.

C. W. ERIKSEN

EXPLORING THE CHILD'S WORLD.

By Helen Parkhurst; introduction by Aldous Huxley. Appleton-Century-Crofts, New York. $3.50. xxx + 290 pp. + 8 pl. 1951.

Helen Parkhurst is a well-known figure in the field of education. In recent years she has developed a technique for interviewing groups of children so that she is able to elicit to a remarkable extent their spontaneous reactions to a variety of subjects. These interviews have been of such dramatic value in revealing the thought processes of youngsters that they have been used, apparently with great success, on radio and television.

In *Exploring the Child's World*, Miss Parkhurst reports on this total experience. She describes her methods of approaching children, her arrangements to permit the maximum amount of freedom in her groups in spite of being "on the air," and her consistent tact and delicacy in inviting the children to say what they think. She takes up, then, the content of a series of interviews —those on the subjects of stealing, lying, good sportsmanship, anger, reactions to a new baby, conscience, death, fantasy playmates, God, parents, and racial prejudice. The children, in their groups of four or five and in ages ranging (for the most part) between 8 and 12 years, have ideas on all of these topics and attempt, often with touching eloquence, to state their positions.

The children do not have very original thoughts. The important thing this report reveals is the groping effort children make to assimilate divergent material they have observed, experienced, been told by parents, or picked up from other sources. In presenting such a graphic illustration of this "child's world," Miss Parkhurst may succeed in reminding parents and teachers that children have an individual point of view which has a logic considered from their perspective, and that this must be respected if an understanding relationship is to exist between an adult and a young person.

Miss Parkhurst must leave out, because it does not come out on a nation-wide hook-up, the non-verbalized part of a child's world which motivates a youngster quite as much as any conscious effort to cope with life. However, a number of books have attempted to present the unconscious factors operating within children that should be taken into account. It is high time a book with a clear-cut practical message to parents and teachers came along. Miss Parkhurst, with her suggestion to "hear a child out" in order to understand his concept of the world, has written just such a book.

HELEN ARTHUR

PERSONALITY. *A Systematic Theoretical and Factual Study. McGraw-Hill Publications in Psychology.*

By Raymond B. Cattell. McGraw-Hill Book Company, New York. $5.50. xii + 689 pp.; ill. 1950.

The author has presented in this volume the outlines of a complete theory of personality. In scope it covers developmental psychology and abnormal psychology as any adequate personality theory must. The author conceives of personality as complex, and has introduced sufficient variables so that the theory has some chance of describing the variety of concrete behavior. Such an attempt is an important one.

Whether the theory is adequate or not is another matter, and one on which there will be much disagreement. The author accepts more innate drives and more complex ones than most psychologists; he accepts them as instincts. He accepts enough psychoanalytic theory to provoke many opponents, but deviates from psychoanalysis enough to estrange many psychoanalytic psychologists. He espouses factor analysis as the best method for explaining the structure of personality—another unpopular position. The tone of the book is that of the tough-minded scientist, but it is pretty dogmatic without presenting sufficient evidence on theoretical points. It is excellent in its coverage of "fact-finding" studies but fails to do justice to opposing

theoretical positions. Despite these criticisms it deserves a wide reading and serious consideration.

A. L. BALDWIN

MEDIZINISCHE PSYCHOLOGIE.

By Ernst Kretschmer. Georg Thieme, Stuttgart. DM. 24. viii + 304 pp. 1950.

This, the tenth edition of this textbook retains its original purpose: to write a psychology which springs from the experience of medical practice and which in turn may serve the tasks and needs of the medical profession. Throughout the book one meets the author's well known constitutional, psychophysical approach to psychology and psychopathology. If we knew and could grasp the totality of all humoral and neurovegetative interrelations in their twofold activity—as this affects the central nervous system and the "psyche" as well as the somatic structure and function system—then we would have to conclude that a particular "psyche" must be linked to an equally particular somatic totality (seen simultaneously from without and from within, functionally as well as anatomically). Experimental investigations which are still in flux have convinced the author that there exist certain root-forms (Wurzelformen) of the personality. These are psychic factors or reaction tendencies which are so simple that they cannot be reduced any further with our present psychological methods. They possess a definite statistical correlation with somatic particularities, especially with "somatic types." Root-forms are elementary psychophysical factors; they represent in any individual personality the sum of all that is constitutional and hereditary. The following are mentioned: the tendency to split between impressions and actions; the tendency towards perseveration; the sensitivity for colors or forms; the readiness to be tense or to relax; the intensity and the pace of emotions; etc. With such qualities of temperament some sociological attitudes and reactions are intimately connected, especially extraversion and autism. Personality traits such as, for example, self-consciousness, inconsiderateness, or loyalty are never given with such primary and elementary biological characteristics. These traits are admixtures of several root-forms and result from their intensive interaction with special environmental influences and specific inner experiences. Aside from the emphasis on the relative primacy of constitutional factors, Kretschmer avoids the adherence to any psychological system. He is deliberately eclectic, taking now from physiology and now from psychoanalysis what he considers to be correct and finds workable. Some of those findings he then translates into his own formulations. He avoids, for instance, the word "Unconscious" and uses instead Schilder's term, "the sphere," giving it a broader connotation. Repression is called the dissimulation, the shamming before oneself, etc.

The aims, methods, and extent of psychotherapy are briefly discussed in the last 32 pages. This chapter shows clearly the author's reasonably eclectic and empirical approach to medical psychology. It aims at a dynamic interpretation of personality functioning and development and is held together by the general conviction of the relatively decisive role of constitutional, psychophysical root-forms. Different personality types demand a different psychotherapeutical approach. It is a mistake to consider some infantile experience a "psychical trauma"; actually, it is nothing else but an early symptom of the individual's constitutionally determined mode of reaction. His own work in the field of psychotherapy has led him more and more to give only second place to the pathogenetic experiences. "With reasonably intelligent and mature patients we analyze less these experiences than the main components of their constitutional personality structure. We follow these components throughout the individual's life history. We do not ask: which are the pathogenetic events and experiences, but: which is the basic outline of his personality structure; in what way has it been used poorly and has become distorted; how can a more harmonious personality be reconstructed with the available assets, and how can the individual reach his highest possible value for the community and his best level of performance."

Kretschmer praises the effectiveness of a particular kind of suggestive therapy which he has developed and which he uses in the treatment of less complicated neurotic reactions. He calls it "the protreptic method" (from the Greek "protrepo," to impel, urge, exhort). Leaving out all magic trimmings the therapist works only with optic, acoustic, and tactile signals. They are administered with energy and great concentration in a sequence skilfully mapped out for the individual patient. It is something of a training. One does not appeal to reason, one does not persuade, but one gives, so to speak, aids as one would to a horse in the riding school. The therapist appeals to the "hypoboulic," animal-like deeper levels of the human apparatus of the will, levels which are always ready to resist blindly or blindly to obey. In all cases, however, the actual conflict-situation which precipitated the neurosis is analyzed and the conflict must be solved.

WALTER O. JAHRREISS

THE EMOTIONAL LIFE OF THE ILL AND INJURED. *The Psychology and Mental Hygiene of Rehabilitation and Guidance.*

By Arthur Jess Wilson. Social Sciences Publishers, New York. $4.75. 416 pp. 1950.

This book is written by the director of rehabilitation

at Grasslands Hospital, New York, and it is good evidence for his familiarity with and enthusiasm about the problems of rehabilitation. He wants to advance a psychosomatic approach to his special field: mind and body whould be considered as one in the restoration therapy of the individual to vocational, social, and emotional well-being. To this end, he advocates an extensive psychological training for specialists in rehabilitation, guidance, counseling, and personnel relations.

Rehabilitation is not placement, nor social service or any part of social service. It is more than a procedure: it is an attitude, a concept, and an approach. Rehabilitation is the work of a team of many specialists with one qualified man calling the signals. To understand the individual person, the psychologist must employ a kind of artistic intuition and insight. Thus a complete psychology is the most complex of all sciences; it becomes an intimate combination of philosophy, science, and art. Throughout the text 50 cases are used as examples and illustrations. Part I deals with the "solving of personality problems." It serves as a kind of introduction to psychology and stresses the "mental hygiene of the emotions" and the "emotional problems of the disabled," with a description of 28 techniques of adjustment, called here "emotional detours." It ends with a chapter on the Rehabilitation of the Neurotic.

Part II is concerned with the ways and means of "combating emotional reactions to injury and disease." Part III considers the "emotional adjustment problems of the veteran as they relate to rehabilitation objectives." The author seems justified in the inclusion of this material. "The war neurosis is substantially the same as the civilian neurosis; and the same principles and techniques that were successful in the rehabilitation of service-connected disabilities have been successfully applied to non-service-connected disabilities."

This book contains much correct information, including many statistical data; and it has a very helpful bibliography of 169 books, papers, and pamphlets, not to count about 50 newspaper articles. Yet, in spite of this the work does not strive for scientific standards. It grew out of practical experience and it wants to be a practical guide. The author's enthusiasm and his spirit of an educational mission are carried by his serious conviction and an obvious sense of moral obligation. He wants to enlighten, to help, and to inspire. For this purpose, his optimism is probably better suited than a scientist's sceptical and critical attitude.

WALTER O. JAHRREISS

EMOTIONAL FACTORS IN CARDIOVASCULAR DISEASE. *Publication No. 97, American Lecture Series.*

By Edward Weiss. Charles C Thomas, Springfield, Ill. $2.25. vi + 84 pp. 1951.

This little volume is another in the valuable series which is becoming so well known to everyone in medicine. Weiss, who is, of course, familiar to all those interested in the rapidly developing field of psychosomatic medicine, has brought together in a brief and interesting manner, the concepts that this new field has to offer the physician dealing with the emotional problems of patients complaining of one or another group of cardiac symptoms. His suggestions are primarily concerned with those cases in which no real evidence for the existence of true organic heart disease is found, in other words, with cases of cardiac neurosis and related pictures.

The part of the book dealing with emotional problems in cases where organic disease has been proven to exist is very limited, but serves to point out the essential fact that "the neurotic patient who has organic heart disease may add a real burden to the work of the heart, either through constant tension of psychic origin or, more especially, by means of acute episodes of emotional origin." The problem of how to cope with such cases perhaps deserved more space than was allotted to it in this short work, which will be of interest to many persons, practitioners and otherwise.

R. G. GRENELL

PROJECTIVE PSYCHOLOGY. *Clinical Approaches to the Total Personality.*

Edited by Lawrence Edwin Abt and Leopold Bellak. Alfred A. Knopf, New York. $6.00. xviii + 485 pp. + xiv (index). 1950.

This is one of the best studies of projective psychology yet encountered. The authors have divided the study into 3 parts: first, a discussion of the theory of projective psychology which, in itself, shows a good deal of new thought and proper reasoning for the justification of such a technique; second, a consideration of individual projective methods for clinical use, a description of the techniques, and a consideration of many of the answers in their clinical situations; third, a part that is probably the least important from the point of view of finished work, and which suggests the wider application of projective testing in various social situations and raises questions of the problems likely to be encountered in the expansion of these methods.

The book is written in such a way as to make it easily followed and easily used by the serious student. At the same time, it gives adequate references for individual investigation and further study. It is not a book for the use of the advanced student, who will, of course, have studied individual methods; but for anyone desiring a well balanced study of the several projective

methods, this is a book which can be strongly recommended.

DAVID ROSS

THE YEARBOOK OF PSYCHOANALYSIS. *Vol. VI. 1950. Managing Editor: Sandor Lorand. International Universities Press, New York.* $7.50. 307 pp. 1951.

For this volume of *The Yearbook of Psychoanalysis* the editors have selected 20 papers which have appeared, with the exception of a study by Robert Flies compiled for the present book, in various professional journals. The contribution by Flies is A Critical Survey of the Post-Freudian Contributions, with specific reference to interest in dreams. This is a very appropriate comparative and critical report of clinical contributions on dreams published in the literature since Freud made his original study. In the subsequent yearbook, Dr. Flies is to continue his survey.

As usual, these papers are exceedingly stimulating and well thought out. They cover a wide range of topics and represent psychoanalytic thought not only in this country but also abroad. One interesting paper, by Dr. Gerda Barag, is from Tel Aviv. It is a report on the treatment of depression and pathological jealousy in a young Jewish male, member of a kibbuz or communal living project in Israel. It is a valuable and impressive report on the resolution, within one year of psychoanalysis, of the patient's profound difficulty. It is also interesting as a glimpse into the life of another culture.

The writers included in this volume, as usual, represent some of the best-known names in the psychoanalytic world—Anna Freud, Bertram Lewin, Ernest Jones, among others. The result is a volume which, like its predecessors, is a worthwhile addition to any library of psychoanalysis. In view of this fact, the number of typographical errors is disappointing.

HELEN ARTHUR

ELEMENTS OF PSYCHOANALYSIS.

Edited, with introduction by Hans Herma and Gertrud M. Kurth; foreword by C. P. Oberndorf. World Publishing Co., Cleveland and New York. $3.00. xii + 333 pp. 1950.

Elements of Psychoanalysis is presented as "a handbook of psychological insights into everyday problems" for the guidance of the lay reader. The editors have organized their book mainly around material written by well-known psychoanalysts whose style often does not seem especially well edited for the non-professional reader. There is, though, through this device of quoting the authorities, no question but that the editors bring the actual essence of psychoanalysis to these pages with no danger that glib rephrasing may miss the real meanings involved. However, some of the chapters may prove heavy going for the uninitiated.

The book is divided into 7 sections. These cover Psychoanalytic Therapy; Elementary Facts and Concepts; Childhood and Adolescence; Family Life; Some Common Problems (papers on Impotence and Frigidity, by Karl Menninger; on Masturbation, by Greta Frankley; and on Homosexuality, by Fritz Wittels); Psychosomatic Medicine; and lastly, Applied Psychoanalysis, a section in which education, religion, and politics are considered from a psychoanalytic viewpoint. In the Appendix, the editors very helpfully provide a clarification of some common misunderstandings of psychoanalysis, a list of books for further reading in the field, and the addresses of all the psychoanalytic institutes in this country.

Altogether, with this volume, the intelligent reader can certainly get a comprehensive idea of what the main tenets of psychoanalysis actually are and where to find out more about them.

HELEN ARTHUR

PRACTICAL AND THEORETICAL ASPECTS OF PSYCHOANALYSIS.

By Lawrence S. Kubie. International Universities Press, New York. $4.00. xviii + 252 pp. 1950.

This is essentially a reprint of a book which first appeared in 1936, but with considerable expansion. Kubie makes his position pretty clear throughout the book as that of a conservative, essentially orthodox Freudian, who exhibits some interest in deviations from the strictly Freudian doctrines yet for the most part finds the departures wanting in depth, and even when superficially good, as being methods not well validated so far. Kubie appears to be a firm believer in the 5-day week schedule (sometimes oftener), and entertains considerable doubt about the value to be attained from any psychoanalysis which does not include the recumbent position on the part of the patient. He also sticks very strictly to the concept of the physician as a person incognito, and delineates a spartan life to which conscientious psychoanalysts must subscribe and which he must actually live if he is to do the best for his clients. I fail to find anywhere the concept of the physician as a warm, understanding human being, the patient's acquaintance with whom for purposes of therapy constitutes the essential, or at least a very important, item in his treatment. According to Kubie, the patient's phantasies about the physician are important but the realities about the physician are not important—if I understand him rightly. All of this follows from a strict interpretation of the theories underlying Freudian psychoanalysis and its practice in an orthodox sense.

The book is full of practical items of undoubted value to any psychiatrist or psychoanalyst of any persuasion.

Particularly noteworthy is the attack on the problem of the financial questions involved. I don't know to what extent the very generous attitude portrayed in the book toward free treatment is actually practiced in New York City, but I know it is said to be common practice among psychoanalysts to give free consultations on occasion, but not to give free treatment. Furthermore, I am unimpressed by his statement that limiting the number of patients psychoanalysts can see by declining to do consultation work limits his earning power. I am sure it is the experience of every psychiatrist that patients under regular treatment are much more sure to pay than are consultation patients, many of whom come unwillingly, sent by somebody else, feel they get nothing from the consultation, and are under no obligation to pay for it. I doubt very much the value of this particular point in his argument. In any case, I think it may be surmised that the psychoanalysts as a group are doing as well as any other group of psychiatrists.

There are a number of other courageous chapters, for instance, those on Psychoanalysis and Moral Responsibility, Psychoanalysis and Marriage, and Social, Economic and Political Change. Also, the problem of the non-medical psychoanalyst is presented with some courage, although many readers may very well find little to favor in the author's plan for training non-medical psychotherapists through short-circuiting the medical curriculum.

In the final chapter on controversies and frontiers, Kubic makes a plea for theoretical research, and to back it up, the establishment of endowed institutes throughout the country. One may wonder if this kind of thing is not to duplicate the frequent experience that the fundamental work is done in a garret, and a handsome building is erected to do the cleaning up process after the fundamental work has been done. One can sense in this no invitation to free, untrammelled thinking on the subject but instead a tendency to promote a monolithic organizational structure which would do anything but promote free research.

If one is concerned with the facts about Freudian psychoanalysts, and their past, present, and future hopes and ambitions, the answers are to be found in this book. If one is concerned with the integration of this doctrine into the general body of psychiatry, he will have to look elsewhere.

WENDELL MUNCIE

THE EGO AND THE MECHANISMS OF DEFENSE. *Third Printing.*

By Anna Freud; translated from the German by Cecil Baines. International Universities Press, New York. $4.00. x + 196 pp. 1950.

This is a new printing of a classic in psychoanalysis. First published in German in 1936 and in English in 1937, this book seems now to be written in an archaic language, although the ideas which the author presents are just as stimulating as ever. It is an analysis of the function of the ego in the development of the personality and describes the various ways that the individual, in trying to reconcile his fundamental motivation to the demands of the outside world as well as those of his conscience, develops personality characteristics the function of which is to avoid anxiety. Some of these defensive mechanisms are denial of certain aspects of the objective world, withdrawal from whole areas of activity, identification with people perceived as aggressive toward the individual, and projection of the individual's own anxiety-producing characteristics onto other people in the form of an "altruistic surrender."

A. L. BALDWIN

CLINICAL STUDIES IN PSYCHOANALYSIS.

By Sandor Lorand. International Universities Press, New York. $4.00. 272 pp. 1950.

This book is a collection of 18 clinical papers covering an unusually wide range of topics. Sandor Lorand has thoughts to contribute on fetishism, on the use and misuse of hypnosis in therapy, on the treatment of child behavior problems, on narcissism, on indecision as an ego-defense, on the handling of depressive states, on perverse tendencies and their influence on personality formation, on the reactions of candidates for the Draft, and other provocative subjects. He writes with authority, equally at ease in a discussion of specific dream interpretations or, in a more philosophic vein, in Comments on the Correlation of Theory and Technique. Any reader can well be astounded at the versatility, not to mention energy, of a scientific writer who stakes out such a big area as his claim.

Under the circumstances, the author must naturally either be superficial or very condensed in dealing with his material. However, in spite of this handicap, Lorand often makes very good points as he hurries along. For example, in the paper entitled The Psychology of Nudism, he exposes the fallacy of the assumption that nudism practised by parents has a beneficial effect on the psychosexual development of their children. Lack of modesty within a home not only does not prevent neurotic upsets in the sexual sphere, but often is in itself the source of considerable disturbance to the child. Lorand goes on to point out that nudism in general is predicated on exhibitionistic and voyeuristic urges which are evidences of immaturity. While he does not produce in this one paper a definitive study of nudism, yet, so far as he takes it, he makes out a sound case for his conclusions.

Lorand has a pleasant style. He illustrates his various themes with interesting if highly abridged case

material. For students of psychoanalysis this book should prove of interest.

HELEN ARTHUR

HUMAN BIOLOGY

INSECTS AS HUMAN FOOD. *A Chapter of the Ecology of Man.*

By F. S. Bodenheimer. Dr. W. Junk, The Hague. f. 10.00 352 pp. + 1 pl.; text ill. 1951.

This volume presents a very completely documented account of the use of insects as food by the more primitive human cultures in various parts of the world. The material is grouped geographically, beginning with the most primitive type of living man in Australia to represent the nearest present-day approach to the beginnings of really human habits before the dawn of history. Later sections relate to Africa, Asia from the Middle East to Malaya, and the Americas. Insect products such as honey and manna are also dealt with at length.

The use of insects as food by the aborigines of both hemispheres is much more extensive than is ordinarily supposed. Not only in times of famine, but under normal circumstances, a great variety and very considerable quantities of insect food are consumed, enough in fact to supply an essential part of the protein and fat in the diet. Thus, the sexual forms of termites, particularly in Africa; locusts, especially the migratory forms in several areas; beetle grubs like lamellicorns, longicorns, and palm weevils; together with gregarious caterpillars are very generally searched for and eaten. In Central and North America the eggs of corixid waterbugs, the preparatory stages of ephydrid brine-flies and other Diptera are gathered and made into nutritious meal by the native Indians. Many tidbits are prepared by roasting or frying a great variety of other insects. Naturally the larger forms are selected, especially those without a heavy exoskeleton or those with the hard parts readily removable. Preparation is commonly accomplished by drying and grinding, followed by roasting, baking, or frying. Many cases are cited of present-day civilized individuals who were quite satisfied with the palatability of locusts, beetle grubs, or other insects when suitably prepared.

Historically, Bodenheimer believes that entomophagy was widespread among prehistoric men, much more so than it is now among living anthropoids, and he attributes our aversion to eating insects to the early development of civilized customs in Europe.

This is an important source book and, moreover, forms interesting reading to all concerned with natural history, human dietetics, or ethnology. It may well be that in the future our rapidly growing human population may be forced to eat some of our highly successful agricultural pests rather than to destroy them by poison or otherwise. This possibility was early discovered by our ancestral stock who staved off famine by eating the invading hordes of locusts.

Unfortunately, the book lacks an index. As the material is arranged by regions and human cultures, this omission is very unfortunate for students in the biological field. Supplemented by a very extensive bibliography of some 20 pages, *Insects as Human Food* will on the whole be a most useful book.

C. T. BRUES

PRINCIPLES OF HUMAN GEOGRAPHY. *Reprint.*

By P. Vidal de la Blache; edited by Emanuel de Martonne; translated from the French by Millicent Todd Bingham. Constable & Co., London. 20s. xvi + 511 pp. + 6 folded maps. 1950.

Reprint of a foremost classic of geography, first published in 1921, and translated into English in 1926. Vidal de la Blache was founder of the modern school of French geography, and one of the first to see human geography in terms of stages in a long historical evolution. The parts of this work deal with Distribution of Population, Elements of Civilisation, Transportation and Circulation, and other aspects of the relation of man to his environment.

PRINCIPLES OF HUMAN GEOGRAPHY. *6th Edition.*

By the late Ellsworth Huntington (based on original work in collaboration with the late Sumner W. Cushing;) 6th edition revised by Earl B. Shaw; cartographic revision by Jameson Macfarland. John Wiley & Sons, New York; Chapman & Hall, London. $6.25 xviii + 805 pp. + 1 folding pl.; text ill. 1951.

Referring to this book, a descriptive blurb reads: "This revision by Dr. Shaw has adhered to the underlying philosophy set forth by the late Ellsworth Huntington but has made some changes in content and arrangement of material. Considerable new illustrative material has been added." With this statement there is no disagreement. However, much disagreement with Huntington's principles has been presented since the original appearance of Huntington's work. To engage once again in a discussion of Huntington's underlying philosophy —his over-emphasis of the influence of the physical factors of the environment on the physiological functions, social behavior, and mentality of various peoples —even though there now exist experimental data, clinical observations, and field studies which contradict many of Huntington's originally provocative statements, would appear to be a task of limited usefulness. Time will be a stronger factor than debate.

M. C. SHELESNYAK

WHERE WINTER NEVER COMES. *A Study of Man and Nature in the Tropics.*

By Marston Bates. Charles Scribner's Sons, New York. $3.50. x + 310 pp.; ill. 1952.

"Occidentocentricism" is a word the author forbore to coin, but which somehow suggests the noisy preoccupation of Western culture with material progress and the mechanical application of its philosophy to the "backward" areas of the world. It is this preoccupation and the mechanical assumption that what the world needs is more of it, that the author begs to question, especially since a large proportion of the "backward" areas are in the tropical zone, for which he has a long-standing and genuine affection.

To make his point, Marston Bates engages the reader in conversation sometimes droll, sometimes complex, occasionally biting, but always delightful. There is a logical plan to his discourse, though it is never obtrusive, and it leads to the inevitable conclusion that Western culture must subject itself to a critical reevaluation if it is to come into harmony with tropical conditions, and with other cultures which may be much better adjusted to those conditions.

As is to be expected, the conversation is most delightful when the author is describing his own experiences, and his views most logically liberal when they concern his own biological interests. In other fields he is more conservative and tends to follow the conventional expositions, even where more liberal views are in conformity with his own thesis. This conventional scientific caution, however, serves only to reinforce the reasonableness of his presentation, with which I for one am thoroughly in sympathy. The academic biologist will find here little in the way of fact that he did not already know; but he will find the material assembled in a way which makes the issue abundantly clear. This book can be thoroughly recommended as a reader in human ecology, used in the best sense of the term; but it is to be hoped that it will find its widest public amongst those men of affairs who possibly have never heard of "ecology."

DOUGLAS H. K. LEE

ANCIENT MAN IN NORTH AMERICA. *Appendix: Geology of the Clovis Sites. Popular Series Number 4. Third Edition.*

By H. M. Wormington; appendix by Ernst Antevs. The Denver Museum of Natural History, Denver. $2.50 (cloth); $1.50 (paper). 198 pp.; ill. 1949.

Few subjects have so great an appeal to mankind as the quest for knowledge in the hazy realm of our distant ancestors. But there are also few subjects in which it is harder for the layman to find his way. The literature is large and scattered and often vastly detailed and quite technical. Wormington has attempted to bring much of this material together in a small book intended for the intelligent and interested layman. The product is good.

The early stone industries are surveyed: Folsom, Plainview, Gypsum, Scottsbluff, Lindenmeier, and the other sites and industries are briefly and simply reviewed. The treatment is conservative throughout, and virtually no attempt has been made by the author either to reconcile widely diverging opinions or to correct probably erroneous notions. Occasional lapses appear; for example, it is stated that the wooded eastern United States did not provide a favorable habitat for mammoths. However, such errors are remarkably few for so extensive a coverage as is attempted here.

There is a survey of the country by areas. A section on early skeletal remains again reviews the melancholy history of frustration and heartbreak that have been persistently the lot of those who have found what they considered to be human skeletal remains in Pleistocene deposits. Throughout this book only the later finds are discussed, no doubt because of lack of space for extensive historical reviews. A summary of the important stone industries gives their characteristics and estimates of their ages. The volume includes a glossary of archeologic terms, a useful bibliography, and an appendix, Geology of the Clovis Sites, by Ernst Antevs. This little handbook makes an excellent starting point for any interested non-archaeologist who wants either a bird's-eye view or a start into the field of ancient man in America.

GEORGE F. CARTER

THE ARCHAEOLOGY OF COASTAL NEW YORK. *Anthropol. Pap. Amer. Mus. of nat. Hist., Vol. 43, Part 2.*

By Carlyle Shreeve Smith. American Museum of Natural History, New York. $1.50 (paper). Pp. 91–200 + 8 pl. 1950.

Three cultures of coastal New York, on the historic time level, are identifiable with known Algonkian-speaking groups. The Shantok was just prior to the intrusion of the Europeans in the 17th century. The East River culture appeared earlier, probably about 1100 A.D. The Windsor culture, which first occupied the entire area but was pushed eastward by the East River culture, and still later was further restricted by the Shantok coming from north or northwest, was the earliest in the area. The underlying preceramic, preagricultural horizon seems to have had relations with the Laurentian culture.

CHIPPEWA VILLAGE. *The Story of Katikitegon. Cranbrook Inst. Sci. Bull. No. 25.*

By W. Vernon Kinietz. Cranbrook Institute of Sci-

ence, Bloomfield Hills, Mich. $3.00. 259 pp.; ill. 1947.

This is an ethnological report based on field work among the Chippewa in 1939 and 1940, and backed by historical sources to give considerable time depth. It is written in an easy, direct style and is bound, printed, and illustrated in a very attractive manner. The usual coverage of subject matter is offered: economy, dwellings, dress, social organization, social life, life cycle, religion, and medicine. Such studies as these are invaluable as sources for such studies as those by Ackerknecht of primitive medicine, or for anyone interested in survival times in subarctic climates in relation to limited clothing and housing, and so forth. The volume of information available in such studies as these is formidable but invaluable.

GEORGE F. CARTER

THE DESERT PEOPLE. *A Study of the Papago Indians. By Alice Joseph, Rosamond B. Spicer and Jane Chesky. The University of Chicago Press, Chicago.* $6.00. xx + 288 pp. + 1 map; ill. 1949.

"This book was written as part of the Indian Research Project undertaken jointly by the Committee on Human Development of the University of Chicago and the United States Bureau of Indian Affairs.

"The immediate objectives of this project were to investigate, analyze, and compare the development of personality in five American Indian tribes in the context of the total environment setting. . . . The ultimate aim . . . is to attempt a systematic evaluation of the . . . new Indian Service policy. . . ." (From the Introduction.)

The book is divided into 3 parts. Part I, People on the Desert, is written by Rosamond D. Spicer. The prehistoric and historic background, the physical setting, and the way of making a living in this desert area are all briefly but well characterized. Part II, Growing up on the Desert, by Jane Chesky, deals successively with The First Four Years, The Child from Five to Ten, The Child from Eleven to Eighteen, and The Papago Child in His Society. Part III concerns The Personality of the Papago Child, and is by Alice Joseph. The tests used and information derived concerning intelligence, emotional patterns, standards of behavior, and society-individual relations are discussed. There is an appendix on the personalities of 8 Papago children. The book is attractively bound, well printed, and has excellent illustrations.

The Papago are emerging as one of the best reported people in America. Ruth Underhill's splendid *Papago Woman's Autobiography*, and *Hawk Over Whirlpools*, her beautiful and moving study of their culture in transition, when taken together with such basic studies as Castetter and Bell's series on the ethnobotany of this region and the excellent present study, make possible a more nearly complete study of the culture-environment relationship than is possible for almost any other primitive folk.

GEORGE F. CARTER

THE MOUNTAIN ARAPESH. *V. The Record of Unabelin with Rorschach Analyses. Anthropological Papers Amer. Mus. Nat. Hist., Vol. 41, Part 3.*

By Margaret Mead. The American Museum of Natural History, New York. $1.50 (paper). Pp. 285–390 + 1 pl.; text ill. 1949.

BIOMETRY

STATISTICAL METHODS FOR CHEMISTS.

W. J. Youden. John Wiley & Sons, New York; Chapman and Hall, London. $3.00. x + 126 pp. 1951.

Although written ostensibly for the laboratory chemist who must needs be concerned with the statistical treatment of his data, this volume is equally useful to the biologist. It is a practical book. It avoids statistical theory where inclusion of it would tend to confound rather than to elucidate, it is concerned with illustrative problems representative of those encountered by the everyday experimenter—the author himself is an experienced chemist—and it assumes that the experimenter knows something about the variables of his data even though he may be unfamiliar with the methods employed in expressing this variation in mathematical and meaningful terms. The coverage carries one through the measurements of precision, and the *t* and *F* tests, to the statistics of the straight line, analysis of variance, and the interaction of factors. The volume is recommended as being both readable and usable.

DE OMNIBUS REBUS ET QUIBUSDAM ALIIS

SCIENCE NEWS 22.

Edited by A. W. Haslett. Penguin Books, Harmondsworth, Middlesex. 2s.; 50 cents (paper). 128 pp. + 16 pl.; text ill. 1951.

Of the 7 articles in this number of *Science News*, 3 are biological in nature: Patterns of Muscle Activity in Posture and Movement (W. F. Floyd and P. H. S. Silver); Pictures in the Mind (J. A. V. Butler); and Photosynthesis (H. Lees). In addition, A. W. Haslett, in his usual interesting Research Report, comments on recent work on protein structure, electric fishes, animal populations, trees and fungi, and microscope research.

BORDERLANDS OF SCIENCE.

By Alfred Still. Philosophical Library, New York. $3.75. x + 424 pp. 1950.

This book reviews the literature of psychical research and parapsychology, including that of the historical antecedents of those fields. While no hard and fast conclusions are set forth, the author does make a rather convincing plea that science is a method and not the pattern of beliefs which happens to be characteristic of scientists in any given epoch. He chides the average contemporary scientist for lack of interest in the borderlands of science which include such phenomena as telepathy, levitation, mediumistic communication, and many others. The author's attitude seems to be uncritically favorable to the allegations of spiritualists and their ilk, but probably he is correct when he asserts that the average scientist, at least in Twentieth Century America, is uncritically negativistic towards such allegations. The book offers only exposition and comment, making little or no contribution to the deeper understanding of the questions at issue.

ROBERT F. CREEGAN

EASTERN ARCTIC WATERS. *Fish. Res. Bd. Can. Bull. No. 88.*

By M. J. Dunbar. Fisheries Research Board of Canada, Ottawa. Free upon request (paper). vi + 131 pp.; ill. 1951.

According to the subtitle, this is "a summary of our present knowledge of the physical oceanography of the eastern arctic area, from Hudson Bay to Cape Farewell and from Belle Isle to Smith Sound." A year-by-year summary of exploration in the Canadian Arctic from 1860 to date, and a brief account of earlier explorations are included. A few papers on biology are listed in the bibliography, but the primary purpose of the compilation is to describe the physical environment.

THE CHEMICAL FORMULARY. *A Collection of Valuable, Timely, Practical, Commercial Formulae and Recipes for Making Thousands of Products in Many Fields of Industry. Volume IX.*

Editor-in-Chief: H. Bennett. The Chemical Publishing Company, Brooklyn. $7.00. xvi + 648 pp. 1951.

This is the cook-book of the industrial chemist, and, for that matter, of anyone else who is interested in what goes into the many industrial products which are available on the market. The amount of information given is tremendous, and its diversity is wide, ranging throughout the entire chemical industry. The recipes are different from those given in previous volumes, and are the latest in a field of rapid change. The editor-in-chief, however, like any good cook, is careful to state that the success of the recipes will depend upon the vagaries of the individual cook, and are not foolproof.

BOTANICAL MICROTECHNIQUE. *Second Edition.*

By John E. Sass. The Iowa State College Press, Ames. $3.50. xi + 228 pp. + 1 pl.; text ill. 1951.

HANDBOOK OF BASIC MICROTECHNIQUE.

By Peter Gray. The Blakiston Company: New York, Toronto, and Philadelphia. $3.00. v + 141 pp. + 30 pl. 1952.

SCHNELLMETHODEN DER KERN- UND CHROMOSOMENUNTERSUCHUNG. *3rd Edition.*

By Lothar Geitler. Springer-Verlag, Wien. $1.50 (paper). vi + 35 pp. 1949.

Each of these three volumes on microscopical techniques has a different objective in mind, and the material discussed varies accordingly. Sass' book, a second edition, is well-known, and needs little introduction to botanists, particularly those who work with sectioned material. For a course in microtechnique it is quite satisfactory, its lack of arbitrariness leaving the instructor or student with sufficient latitude to exercise his own ideas on improvement at the same time that the framework of reference leaves no doubt as to general procedures. Gray's volume is equally satisfactory, but with emphasis on animal tissues. The student will appreciate the numerous illustrations concerned with the handling of sectioned materials. The chapter on smearing, however, is so inadequate as to be useless except for tissues such as blood. Geitler, on the other hand, has concentrated on the smear technique as it relates to nuclear and chromosomal studies, with a discussion of the special applications for particular problems. A combination of the three volumes within a single cover would adequately cover the general techniques of sectioning and smearing for both plant and animal tissues, although all three assiduously avoid the new cytochemical and histochemical techniques applied to specificities and quantitative determinations.

C. P. SWANSON

FRENCH-ENGLISH SCIENCE DICTIONARY. *For Students in Agricultural, Biological, and Physical Sciences. With a Supplement of Terms in Aeronautics, Electronics, Radar, Radio, Television.*

By Louis De Vries; with the collaboration of members of the Iowa State College Graduate Faculty. McGraw-Hill Book Company; New York, Toronto, and London. $6.50. xii + 596 pp. 1951.

De Vries' first edition of his *French-English Science Dictionary* contained some 43,000 entries covering terms of the agricultural, biological, and physical scien-

ces, as well as many literary terms. This, the second edition, contains nearly 50 additional pages of supplementary definitions and terms that have come into our vocabulary as the result of recent developments in the fields of aeronautics, electronics, radio, radar, and television. These new definitions and terms were simply added to the rear of the dictionary, apparently to save the cost of resetting type for the entire book. This unfortunate arrangement means that the user must remember to look for English translations in two places, since many French words appear both in the main part of the dictionary and in the supplement. Despite this shortcoming, the present volume should be a worthwhile addition to a scientist's library.

A. CHAPANIS

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, *Showing the Operations Expenditures, and Condition of the Institution for the Year Ended June 30, 1950.*

United States Government Printing Office, Washington. $3.00. x + 522 pp. + 84 pl. 1951.

In addition to the customary reports, the usual fine section of reprinted and new scientific articles occupies in this annual volume 344 pages and is illustrated by numerous line drawings and 82 plates. Articles of a biological nature include the following, reprinted from other journals: Electroencephalography (W. Grey Walter); Natural History in Iceland (Julian Huxley); Man's Disorder of Nature's Design in the Great Plains (F. W. Albertson); Food Shortages and the Sea (Daniel Merriman); and The Economic Uses of Lichens (George A. Llano). Original articles are the following: Praying Mantids of the United States. Native and Introduced with 9 plates (Ashley B. Gurney); The Origin and Antiquity of the Eskimo, with 4 plates (Henry B. Collins); and Archeology and Ecology on the Arctic Slope of Alaska, with 6 plates (Ralph S. Solecki). Besides these, there are 10 articles ranging from astronomy and physics to aeronautics and S. Seymour, a pioneer painter of the Great Plains. One can choose to read Schrodinger on elementary particles or Pauling on chemistry and the future. Those biologists who would like, by reading widely in general scientific fields, to broaden their knowledge and to pick up invaluable material for teaching purposes, are missing the greatest bargain in scientific books if they overlook the Annual Reports of the Smithsonian Institution. Where else can one obtain nowadays a bound volume of excellent scientific articles, illustrated with numerous plates at a cost of less than 1 cent per page? The same type of material, in more widely advertised books, costs today well over that ratio, which is calculated without allowing anything at all for the cost of the 150 pages of the Secretary's Report proper—which also contains interesting material.

BENTLEY GLASS

THE QUARTERLY REVIEW OF BIOLOGY publishes critical reviews of recent researches in all of the special fields of biological science. The contribution should present a synthesis or digest of the researches and a critical evaluation of them. A mere synopsis of the literature without evaluation or synthesis is not desirable.

Theoretical papers are published occasionally, especially when such papers (1) include a critical synthesis of the literature bearing on the theory and (2) are likely to promote further research in a given field.

The article should be written in concise language, yet in sufficiently non-technical form as to be intelligible not only to specialists in other fields but to the general biologist as well. To this end the article should have a general introduction and a summary which enumerates one by one all of the principal facts and conclusions given in the paper. Interpretative diagrams and schemes are very desirable.

Material ordinarily taking the form of footnotes is set in small print and placed in the text and consequently should be written in a style so as to fit readily into the text. Acknowledgments are printed in the text in small type at the end of the article just preceding the List of Literature. Recent issues of the Quarterly should be examined for style as regards (1) section or subsection headings in the text, (2) literature citations in the text, and (3) List of Literature.

The subjects and authors of articles are selected by the Editors and members of the Advisory Board. Unsolicited articles which conform with the objectives of the Quarterly will be considered for publication.

A feature of the REVIEW is the section dealing with *New Biological Books*. In this department the book literature of different countries in the field of Biology is given prompt notice.

The QUARTERLY REVIEW OF BIOLOGY is issued in March, June, September and December.

Twenty-five reprints, with covers, of articles will be furnished to contributors free of cost. The reprint order blank accompanying galley proofs gives the cost of additional reprints.

Manuscripts may be sent to Dr. B. H. Willier, Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland.

Books for Review may be sent to Dr. H. B. Glass, Department of Biology, The Johns Hopkins University, Baltimore 18, Maryland.

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